~~COGNITIVE PROCESSES IN LECTURE NOTETAKING~~

~~Prior Knowledge, Patterns of Information Uptake and Comprehension.~~

Notetaking in lectures: the relationship between prior knowledge, information uptake and comprehension

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ABSTRACT

Notetaking during lectures has been mainly investigated using an input-output procedure where particular subject variables are related first to notes-as-product, then to comprehension test scores. In contrast, the purpose of this thesis was to look at notetaking as a process rather than a product and to discover factors that influence the process.

The first, orienting study took a fairly traditional approach of training students in the use of two strategies -summarizing and networking- hypothesized to improve notetaking activity. Training was administered for a period of six weeks. Results indicated a main effect for mathematical ability but not for training. Differences in mean scores for training methods were non significant and not in the hypothesized direction: networking > summarizing > control.

The next study was a first-approximation to a true processing analysis. Students' self-estimates of prior knowledge, as well as the volume of their notetaking were linked to strategic and tactical processing variables such as whether lecture material was written down as heard or translated into own terms; whether they wrote only important points, and so on. This pattern was then further related to self-estimates of lecture comprehension. The pattern of relationship among processes, and between these processes, note volume and comprehension varied with differing amounts of prior knowledge and with language ability.

The third study was more ambitious in its approach to processing variables. A videotaped lecture was segmented into idea units with a pause between each unit. For each segment, students took notes as well as recording their understanding of it. A regression model for the data shows that while self-estimated prior knowledge appeared related to outcome variables (e.g. comprehension),

it did not relate to understanding of the lecture as it was being delivered. A more detailed analysis by segments revealed that notes reflected the status of transmitted information with regard to importance and the level of understanding achieved for specific pieces of information. Mean lecture comprehension accounted for the largest percentage of variance in the number of words in notes.

Findings are discussed with respect to contemporary theories of notetaking and comprehension. A cognitive model of notetaking detailing how the various processes are instantiated and related is also offered.

DEDICATION

TO MAMI

MRS CLAUDIANA ATINUKE AINA
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without whom this work may
have been impossible.

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CHAPTER 1

INTRODUCTION

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1 . 1 INTRODUCTION

> "In the past, books were relatively rare and expensive and the practice of note-taking, in conjunction with the lecture method of instruction, provided an indispensable means of passing on recorded knowledge to students in relatively large numbers. Now circumstances have changed, and the physical reproduction and storage of knowledge pose few problems for which modern technology cannot offer cheap and convenient solutions. In the age of the mass-produced duplicator and Xerox machine, taking notes appears to be a somewhat laborious alternative,"(Howe,1975).

> ".....,(E)ducation in Sub-Saharan Africa is in crisis today. Rapid population growth has resulted in more children than ever seeking places in schools already pressed for resources because of the financial crisis of the 1980s. ....Classrooms have become overcrowded and teaching materials increasingly scarce," (World Bank,1988).

These two quotations clearly set opposed positions. Although frequently criticized on various grounds, verbal presentation of material by a teacher would seem to be one of the cheapest and potentially efficient teaching methods available. The research in the present thesis is aimed, as Brown (1978) advised, at improving the usability of the method by investigating what the method is purported to do best -transmission of information - by examining how students convert the transmitted message into their notebooks in a lecture situation.

The lecture has great appeal in situations like those which characterize African Education where books are few. The economic difficulties that Nigeria and indeed other African countries are currently experiencing demand that cheaper, more efficient means for reaching desired educational goals be sought. Most African nations have adopted austerity measures owing to depressed national fortunes. Education budgets have shrunk. Teachers' salaries which constitute a gigantic share of the education budgets cannot easily be trimmed without unpleasant political consequences. Increasingly therefore teaching materials, principally books, have become difficult if not impossible to obtain.

Thus the quotation by Howe (1975) which heads this chapter is simply not applicable in African countries. This is not the past but the reality of the African condition today. As for the assertion that this is the age of the duplicator and Xerox machine, even now, more than a decade after Howe's observation, these machines are not mass-produced or mass-available in Nigeria or in Africa generally. Furthermore, the service these machines offer is far from cheap. They are expensive to run and maintain with costs being transferred to the students/users for whom notetaking is the far less expensive option.

In addition to the rarity of books, and the expense and unreliability of photocopying, the expansion in school enrolments places a severe strain on limited educational materials. The World Bank (1988) report on Education in sub-Saharan Africa indicates that the numbers of students at the tertiary level had grown from 21,000 in 1960 to 437,000 by 1983. This growth in educational places has not been matched by a corresponding increase in material and resource provisions. In fact the World Bank points out that educational spending dropped from $10 billion in 1980 to $8.9 billion in 1983.

All the foregoing considerations make the search for policies and techniques that make optimal use of the the prevailing conditions mandatory, and the present research is one attempt in that direction. The aim of the present research was thus to examine how the potential of the lecture might be optimized not through training in skills of the lecturer but through the improvement of notetaking on the part of the student.

From this general background, let us focus down to the circumstances of the individual teacher. As a classroom teacher myself, I began to worry about my students' diffident learning in educational psychology. The quite heavy reliance on lecture notes exhibited by students was clear. It was tempting to hypothesize that learning and notetaking were closely related, and in non-obvious ways. The possibility of investigating this has been made feasible by two developments in psychology and particularly in educational psychology. The first is the revived interest in cognitive psychology stemming from work on artificial intelligence and information processing, and this has provided a theoretical base for the investigations. A second, rather different development over the past ten years has been an increasing interest in students' own perceptions of the learning process.

The methodology adopted in the research to be reported was a mixture of the experimental and naturalistic. The studies were conducted in live classrooms although in two of the studies (2 & 3) laboratory-type control was built in. Use was made of of both self-reports and a range of objective measures.

Briefly, it was therefore wished to examine:

1. The factors that influence notetaking.

2. How notetaking processes relate one to another.

3. How notetaking processes relate to prior knowledge,

   within lecture understanding and to post-lecture

   comprehension and recall.

1.2 OUTLINE OF THESIS

The thesis can be seen as in three parts. The opening section which comprises Chapters 1, 2, 3, and 4 presents background material for the study and includes an examination of the pertinent literature. The second part - Chapters 5, 6, and 7 - consists of reports of three separate investigations which have developmental sequence. The final section of the thesis, Chapter 8, is concerned with the evaluation of all three studies and includes interpretations and recommendations for notetaking practice and future research.

1.3 OVERVIEW

Chapter 1. Introduction:
The reasons for and aims of the study. The general rationale for the methodological approach and an overview are given in this chapter.

Chapter 2. The lecture as the context for notetaking.
An assessment is made of the research which has given support for the conflicting notions that the lecture method is effective or ineffective.

Chapter 3. The notetaking literature.
This review traces the development of research on notetaking from early studies really concerned with the effectiveness of the lecture method to more recent experiments in the training of notetaking strategies. Although a great deal of information has been generated on factors related to notetaking, the theoretical basis advanced to date is shown to be unsatisfactory. Too great an emphasis has been placed on the gathering of evidence for one of two

hypothesized functions of the activity, namely, encoding and external storage.

Chapter 4. The problem.
The activity of notetaking is located within the wider frameworks of information processing and schema theory. Specific questions with which the present investigations are concerned are detailed.

Chapter 5. Study 1: Training for notetaking.
The results of a six-week intervention study conducted in a live classroom in which training was given in the use of two strategies hypothesized to improve notetaking at lectures. Strategy training did not appear to change notetaking behaviour although all trained groups obtained higher scores on an end-of-term test. The difficulty of conducting studies with experimental type controls in natural settings is highlighted.

Chapter 6. Study 2: Notetaking processes.
Processes deployed in notetaking based on reports collected with the help of a process inventory administered immediately following an actual lecture. This study identified, possibly for the first time in the area of notetaking, the cognitive processes that are actually set in motion during notetaking. An attempt is made to relate process (strategy) deployment with such factors as familiarity with subject matter and language ability. The discussion highlights differences in processing models among different types of students.

Chapter 7. Study 3: Prior knowledge, notetaking and comprehension.
A within lecture analysis of notetaking processes was undertaken. A video lecture was segmented in such a way as to allow both students and lecturer to evaluate notes taken on each idea unit. The relationship between processing variables and input and

outcome variables (comprehension & recall) is discussed.

Chapter 8. Conclusions.
Evaluates the studies reported and offers a model of notetaking activity along with some recommendations for future research on notetaking as a skilled activity.

CHAPTER 2

THE LECTURE AS CONTEXT FOR NOTETAKING

CHAPTER OUTLINE

2.1 INTRODUCTION

Of course notes are not only taken in lectures; they may be taken from books or more generally in non-academic settings. However the concern in this thesis will be with notes as taken in "lectures" as when a teacher verbally conveys his or her account of some academic theme. Accordingly, a knowledge of conditions that apply in lecturing may be useful in explaining or predicting when and how notes will be taken.

The lecture typifies university and teaching. Costin, (1972) and Hoover (1980) attest to this when they separately and similarly aver that "of all methods of college teaching lecturing is the most widespread" (Costin); "The lecture is currently the most widely used ....instructional method in colleges and universities" (Hoover,1980). The extensive use of the lecture is matched by a paradoxical degree of disbelief of its effectiveness. The method is variously criticized for being teacher-centered, monotonous and failing to permit active learning. It is even regarded by some as anachronistic (e.g. Johnson, 1781).

The task in this Chapter is twofold:

(i) The lecture method is examined closely from its early beginnings to more recent approaches that have developed in response to intermittent calls for change.

(ii) Both informal opinions and formal studies which have attempted to assess the comparative effectiveness of the lecture against other methods of instruction are surveyed and their conclusions evaluated in order to provide pointers for the present research.

I shall not undertake a comprehensive analysis of the nature of lectures but treat only the aspects which seem relevant to the role of the lecture in the present thesis - that of a context for notetaking.

1.2 CHARACTERISTICS OF THE METHOD

The lecture has been in existence for close to 2,500 years. Its origins can be traced to the Greeks, to Plato and his students. At a time well before the development of printing, the lecturer, the master, usually in possession of the only available copy of the book or manuscript read to his students. The reading and commentary was close to a theatrical performance and was expected to provoke critical thought in the audience.

The method became adopted by universities of medieval Europe and those of the Muslim East into a system which is still closely associated with teaching in higher education.

Exploring the strengths and weaknesses of the lecture provides a useful way of examining the properties of the method. Gregory (1975), effectively summarized the major strengths and weaknesses in a tabular form (Table 2.1).

Table 2.1

Strengths and Weaknesses of the Lecture Method

Strength		Weakness
1.	Familiar.	Learner individual differences not catered for.
2.	Economical of staff time.	Inadequate for audience understanding and reaction.
3.	Amenable to large audiences.	Heavy burden on memory and notetaking.
4.	Relatively easy to mount.	Quantity and quality of information received varies from student to student.
5.	Covers more material.	Demands sustained concentration aural and visual.
6.	Uniform information transmitted.	Little or no active participation.
7.	Content, time and equipment adaptable to audience.	May develop few high level intellectual skills and attitudes.
8.	Allows spontaneity.	Requires careful preparation and presentation.
9.	Can be recorded and transcribed.	
10.	Can be an organised and systematic presentation of content.	

Variants of the lecture have evolved which attempt to reduce particular weaknesses of the method. For instance, the lecturette helps apprehension span by greatly reducing the length and time of exposition while maximizing impact through more focused coverage. Other variants such as eclectic and filmed lectures increase the use of other sensory modes. Despite the existence of these alternatives, the traditional lecture is still preferable under certain circumstances. According to Hoover (1980), these include when; (1) the necessary background information is not readily accessible to students, (2) the facts or problems are conflicting or confusing, (3) unique experiences of an individual will substantially contribute to clarification of issues, (4) time is pressing and the sources of data are widely scattered, and (5) the best way to understand the topic is through oral presentation. Cockburn & Ross (1977) also point out that the lecturer can bring the subject to life, being him or herself a "model of personal relevance" that students can imitate or challenge.

Despite its usefulness and advantages, the lecture remains the most greatly criticized method of instruction (Costin, 1972). However, the empirical evidence does not seem to support the widespread lack of faith in the method.

2.3 INVESTIGATIONS ON THE LECTURE METHOD

In response to criticism levelled against the method, systematic investigations to assess the relative effectiveness of the lecture and other methods of instruction increased in number. The effectiveness of the lecture was compared with those of other methods of instruction, a practice referred to by Dunkin (1983) as "comparative methods experiments". Comparisons were made between lectures and discussions projects, reading (guided and unguided) and other kinds of self-instruction, for example laboratory work. In a few instances the lecture was compared with no class attendance at all! These studies received increased attention from the 1940's, the prime impetus being the controversy surrounding the advantages and disadvantages of "student-centred" as opposed to "teacher-centred" teaching, sometimes termed directive and non-directive, following the

work of Rogers (1969). This controversy was to a large extent a continuation of the earlier controversy between advocates of the lecture method on one hand and those of the discussion method of teaching on the other.

In all these studies, the criterion has usually been some measure of outcome presumed to be the result of the treatment or teaching method. In a small number of studies (e.g. Ruja, 1954; Smith, 1955; Johnson & Smith, 1953; Asch, 1951), the criterion was the degree to which the "consumers" preferred one or other method. Some studies such as those by Wispe (1951), Beach (1960) and Eglash (1954) also attempted to measure and analyse pedagogic behaviours. The underlying assumptions in these three kinds of research has been that the value of the lecture method is directly and simply interpretable through the manifest indicators being measured. In fact, as Johnson, Rhodes & Rumery (1975), quoting Anderson and Hunker (1963) put it; "these three approaches to the evaluation of teaching have reached a dead end".

Tables 2.2 and 2.3 summarize studies of comparisons of lecturing with other methods of instruction - in psychology in particular, though in a few instances in other related subjects. The restriction to the specific subject area of psychology is for reasons of containment as well as reflecting the direction taken by the three studies to be reported in this thesis.

2.3.1 Lecture Versus Discussion

Table 2.2 presents studies which have compared lecturing with discussion. Of the nine studies located which compared performance of groups taught by either the lecture or discussion methods, four found no significant difference in the methods. In three of the studies, the lecture groups were found to be superior to the discussion groups on the criterion of earning higher test scores. In two of the studies the discussion groups were found to have greater gains and less irrelevant and passive thoughts.

TABLE 2.2

Lecture Versus Discussion

Name	Year	Subject Matter	Treatment	Criterion	Findings
Spence	1928	Educational Psychology	2 groups, lecture and Discussion	Achievement tests after each method	Lecture superior in producing improvement in tested qualities.
Asch	1951	Psychology	3 groups, 2 taught by lectures, 1 discussion	Final examination score (objective and essay questions) + measure of attitude change.	Students in lecture groups scored significantly higher. Students rated discussion class higher in helping them to learn subject matter, but scores were actually lower. No difference in attitudes between groups.
Johnson & Smith	1953	Psychology	2 matched groups taught by lecture and discussion.	Class evaluation scale Attitude scale and 150 item achievement test	Students evaluated discussion class more favourably(NS). Neither method had any consistent effects on attitudes. Discussion did not produce academic superiority.
Bloom	1953	Social Science Humanities Biological Science	5 lecture classes discussion group	Thoughts reported	Irrelevant and passive thoughts occurred twice as frequently in lectures as in discussions. Conclusion: Lecture much less successful in holding students' thought to the immediate.

Eglash	1954	Psychology	Two classes, 1 discussion, 2 lecture	Multiple choice quiz fortnightly, final achievement test Teacher evaluation	No difference in achievement between the two classes. Discussion class felt they had learned little, the lecture class felt they learned a great deal.
Ruja	1954	Philosophy & Psychology.	2 groups; one discussion the other lecture	Examination of facts Understanding Reasoning ability Gains in emotional adjustment Expression of attitudes Acquaintance with fellow students	Students in the discussion group did not surpress those in lecture group in subject mastery. No difference in adjustment gains. No significant difference in attitudes. Students in discussion group got to know one another in greater numbers than in the lecture.
Smith	1955	Psychology	2 groups, 1 - discussion 2 - lecture	90-item multiple choice initial and final test of achievement Measure of satisfaction	Discussion class made greater achievement gains than lecture class. No difference in overall satisfaction.
Beach	1960	Sociology	Five treatment groups Group 1, lecture, Group 2, Discussion, Group 3, Autonomous - discussion Group 4, Independent Study, Group 5, Control	60 - item achievement test - factual recall	The lecture group performed significantly better than the other groups. Introverts performed better than extroverts in the lecture and discussion groups and vice versa in the autonomous groups.
Wispe	1951	Social relations	Two groups directive and non-directive teaching	Examination results Expressed opinions and feelings	No difference in final examination score. Most students preferred directive to non-directive teaching. 'Duller' students benefited more from directive teaching. 'Bright' students did equally well under both methods. Students enjoyed non-directive teaching but did not consider it much value.

If we consider in addition to the nine studies noted above, investigations by Bane (1925) and Corey (1967) which did not deal with the subject matter of psychology, the picture still does not change very much. Bane (1925) found little difference between both methods on measures of immediate recall, but the discussion group scored significantly higher on a measure of delayed recall. Corey (1967) on the other hand, whose study is sometimes regarded as a comparison between lecture and reciting (Bligh, 1970) found that the lecture was more effective on immediate recall. On delayed recall, however, there was no significant difference between the two groups.

In addition to factual knowledge, some of the studies attempted to evaluate the teaching methods using attitude indicators such as measures of satisfaction and opinions of expressed liking as indicated earlier. Ruja (1954), Smith (1955), Johnson & Smith (1953), and Asch (1951), found no consistent attitudes towards the methods. The students in the Asch (1951) study rated student-centered teaching higher than lectures in helping them to learn subject matter, but their actual test scores were lower than those of a teacher-centered group. The discussion class in the study by Eglash (1954), felt they had learned little while the lecture class felt they had learned a great deal.

Some studies have compared different schedules and combinations of lectures and discussion, (Goldberg, 1964; Longstaff, 1932; Remmers, 1932; Eash & Bennett, 1964; Faw, 1949; Bills, 1952). The usefulness of this line of research is doubtful when the more fundamental question "which method is better?" has not itself been adequately answered. Furthermore the data in studies of this kind typically do not go beyond the descriptive.

In a few of the studies reviewed by Costin (1972), knowledge was measured separately from other rather loosely defined cognitive skills such as problem solving. It was observed that discussion had an advantage over the lecture with respect to cognitive learning skills, and Costin formed the conclusion that discussion is indeed more effective than the lecture for teaching cognitive skills.

Nevertheless, when all results are put together, there is really no clear indication that one method is better than the other. There is however, a noticeable though small tendency in favour of lectures when factual information recalled either at the end of a course (delayed) or an experiment (immediate) is the criterion measure.

Concluding their reviews on the comparison between lecture and discussion methods, Costin (1972), and Dubin & Tevaggia (1968), propose that the two methods do not differ in their effectiveness. Costin (1972), even surmises that "lecturing would appear to be more efficient for facilitating ... students' acquisition of information" (p.10). This conclusion is similar to that reached by Joyce and Weatherall (1957) in a study comparing discussion with lectures as well as with unsupervised reading. They found that while the discussion group had the greatest knowledge of subject matter, when time consumed and economic use of staff were added to the equation, the efficiency of the lecture was highest. This of course raises the further question of whether efficiency is preferable to effectiveness as the criterion for assessing a method of instruction.

2.3.2 Lecture Versus Independent Study

A number of studies have compared lecturing with various modes of independent study and self-directed activities such as reading, self-study, auto-instruction and laboratory work. Table 2.3 presents a summary of some of these studies.

Of the studies to be reviewed here, five found no significant differences between groups experiencing lectures and those engaged in independent study, including reading. Bligh (1970), also found no difference in performance on multiple choice tests of knowledge and comprehension between a lecture group and read only group. For six of the studies in Table 2.3, independent study was found to produce superior performance, while in five other studies, the lecture method resulted in better performance on the criterion tests sometimes ac-

companied by such qualifying remarks as "for low ability students" or "for delayed testing".

On the whole, as in the case of lecture versus discussion, the evidence does not lean overwhelmingly in any one direction and it is therefore not possible to state unequivocally which method is the better.

TABLE 2.3 - LECTURE VERSUS INDEPENDENT STUDY

Name	Year	Subject Matter	Treatment	Criterion	Findings
Greene	1928	Psychology	2 groups of lecture and read lecture content	Achievement tests. Immediate and delayed recall	On immediate test, no difference in scores between lecture group and read only group. Lecture more effective for low ability students. Reading more effective for high ability students. Delayed testing lecture group superior.
Greene	1934	Psychology	3 treatment groups of lecture, read content and read lecture content guided by questions	Delayed retention of facts and principles	Self instruction most effective - produced highest scores.
Jensen	1949	Educational Psychology	2 groups of lectures and No lecture The no lectures group studied in laboratory rooms getting immediate feedback	Achievement test	The laboratory group showed significantly higher achievement. (But these students had superior GPA's in high school and high scores on the entrance examination.
Cook & Cook	1950	Educational Sociology	2 groups lecture and Student Project	Comprehension Interpreting data Professional attitudes	Project students made greater in interpreting data and developing professional views.
Parsons, Ketcham & Beach	1958	Developmental Psychology	Lecture versus independent study using a syllabus	Achievement on factual textbook material Attitudes toward working with children	Independent study group achieved more. No difference in attitudes.

Table 2.3 Cont'd

Name Year	Subject	Treatment	Criterion	Findings
Marx, Plath, Wakely & Wilkins 1960	Psychology	Two groups : 1. Lectures plus assigned readings 2. No lectures, assigned readings plus question sessions	Test on factual knowledge	Lecture group acquired more factual knowledge than did the group which had assigned readings and no lectures.
Leton 1961	Child Development	Lecture vs student project	Knowledge of facts and principles Attitude towards children	No differences.
Caro 1962	Psychology	Lecture vs self directed study, no class attendance	20-item examination	No significant difference in mean performance between the two groups.
Ripple 1963	Psychology	3 experimental groups 1. Lecture 2. Read lecture content in conventional text format 3. Programmed text of lecture content	Student achievement. Immediate and delayed recall	Lectures on the whole most effective. On delayed retention measures the lecture group scored higher than the reading group.
Hartnett & Stewart 1966	Psychology	Lecture vs self-directed study with no class attendance (six courses)	100-120 item final examination (achievement)	In two of the courses, mean performance of the independent study group was higher than that for the lecture group.
Hunt & Mathis 1966	Psychology	Lecture vs assigned readings, programmed materials	Scores on a 230-item test of knowledge and examination scores.	No significant difference.

2.3.3 Class Size

Another line of research is that concerned with the optimal size of a group for effective lecturing. Research on class, lecture or group size (de Cecco, 1964; Cottrell, 1962; McKeachie, 1968; Bligh, 1972a; Wood, Linsky & Strauss, 1977), has not really improved our state of knowledge, as almost equal numbers of studies report no significant differences as report positive or negative results with respect to large lecture groupings. This strand of research would be more useful if the lecture could be shown to be more or less suitable or effective for a particular class size. It would also be beneficial to establish how specific technological innovations could be put to effect among groups disadvantaged by size.

2.3.4 What Is Learned ?

Another kind of research evidence concerning the utility of the lecture is provided by studies which have attempted to measure and evaluate the learning that occurs in lectures, and these are more useful. Table 2.4 gives a summary of seven studies which assessed the amount of material students carry away from lectures either in their books as notes taken, or in their heads. The aim in these studies is also to assess the effectiveness of the lecture as a method of instruction though comparisons are sometimes made.

Findings from all the studies surveyed, suggest that a substantial part of the material presented is lost. The students take away about half of the material but this too suffers rapid attrition. It seems therefore, on the basis of evidence from these studies, that the lecture is not a particularly effective method of teaching.

TABLE 2.4 Assessing Learning From Lectures

Name	Year	Subject Matter	Treatment	Criterion	Finding
Jones	1923	Psychology	782 Students in in 30 lectures	Immediate memory for materials presented 500 questions	62% of material retained. Conclusion - Forgetting lecture material was a lawful character. The curve of forgetting starting at something of 60% on immediate recall and declining to about 20% of remembered material 8 weeks later.
Bartlett	1932	Psychology	Stories presented	Remembering verbal material	Connected verbal material rapidly forgotten and transformed due to preconceptions.
Trenaman,	1951 1967	General Knowledge	Matched samples (listening) in 3 treatment conditions radio, T.V. & Print.	Assimilation of recorded broadcast	Assimilation and retention of material minimal.
McClendon	1958	Psychology	678 Subjects	Note taking and Comprehension	Comprehension unaffected by taking or not takingnotes. Taking down main points only did not impair Comprehension.
Fryberg	1965	Psychology	Lecture	Note taking and recall of lecture material in immediate and delayed (2 weeks, 8 weeks) tests.	Listeners performed better than detailed note takers on immediate test and on 2 weeks delayed test. Note takers performed better on 8 weeks delayed test.
McLeish	1968	Psychology	Lecture	Note taking and recall of lecture material	40% of material presented retained/ recalled. One week later half of this was forgotten.
Hartley & Cameron	1967	Psychology	Lecture	Compared notes taken by students with ideal notes. Informational units in students' notes counted.	Approximately 1/3 of what was said was noted. Content agreement with ideal notes varied from 70% in first 10 minutes to 20% in the final period of lecture.

Although the concern in this thesis is not with the effectiveness of lecturing but with the nature of note production, it is nevertheless useful to point out some of the flaws in these studies.

In the first place, none of the studies in Table 2.4 was conducted over an extended period with thematically related material. Yet results from a one-off lecture may underestimate recall because subsequent lectures bearing on related themes and which may yield improved levels of recall do not take place. Secondly, the notes taken in an experimental study may be too insubstantial. This could be for a number of reasons including lack of real relevance and purpose. None of the studies in Table 2.4 pursued the question of what students did with the notes taken.

Studies which used more appropriate analytical method reported more favourable results. These include studies in which the analysis of students' written notes involving the identification of main ideas was carried out (Hartley & Cameron, 1967; Maddox & Hoole, 1975). A high correspondence between points identified as important by teachers and ideas recorded in student notes was reported. Results such as these accentuate the methodological weaknesses in the studies reported earlier.

2.3.5 Methodological Deficiencies

Although as noted, research and practice have generated an enormous number of studies of alternatives to the lecture which differ dramatically (e.g. discussion, independent study, lecturette), Kulik & Kulik (1979) point out that these alternatives seem nonetheless remarkably similar to the lecture in terms of outcomes. This stems largely from methodological inadequacies.

Heim (1976), and Ellner & Barnes (1983), argue that the poor statistical support for other learning methods may reflect imprecision in the observational tools

and statistical methods along with the failure to take cognizance of the fact that college students engage in a great deal of study outside class. Ellner & Barnes (1983) note that a second reason may be due to the fact that the variables are imprecisely defined, creating flabbiness in the results. Thirdly, they argue, researchers have continued to see teaching as an act in itself divorced from a specific subject area or group of students. They aver that "while a few teaching skills may be consistently valuable across all ages, and content areas, there will be many more skills that vary in effectiveness in relation to course level and subject area" (p.23).

2.3.6 Summary

In summary, the long history of research on the effectiveness of various colleges instructional methods has failed to show than there is any consistent and useful difference between methods which are discernibly disparate. But as Birney & McKeachie (1955) prophesied, we do now have a better understanding of the effects of various teaching methods upon student learning. Bligh (1970) summed up the state of knowledge about teaching methods thus: "the lecture is as effective as any other method for transmitting information, ... most lectures are not as effective as more active methods for the promotion of thought, and changing student attitudes should not normally be the major objective of a lecture" (p.4)

Most reviewers agree on the conclusions that, (i) teaching by discussion is neither more nor less effective than teaching by lecture when the criterion of effectiveness is learning of factual information; (ii) teaching by discussion is more effective than teaching by lecture for more ambitious cognitive objectives such as developing problem solving ability.

There is, however, less consensus concerning the effectiveness of either the lecture or the discussion method in changing attitudes. There is also disagreement about student satisfaction with the methods, for while Costin (1972) finds no

consistent differences, other researchers report greater satisfaction in more instances for the discussion method.

2.4 CONCLUSION

The research with all its attendant weaknesses shows no large differences among most of the methods when compared globally. The conclusion that they share something in common is irresistable. Dubin and Tevaggia, (1968), maintain that different college teaching methods share equal facility for transmitting knowledge to the next generation - a major function of education.

On such an argument, there is therefore no overriding reason why the lecture ought to be discarded as a method of instruction emphasizing the imparting of information. If the economic argument on the non-accessibility of books in many countries is also added, then the viability of the lecture in principle seems hard to deny. Further, it is possible to argue a case for lectures and notetaking without indicting alternative pedagogical methods. Indeed in a practical teaching package one would expect to see some element of each represented. Nevertheless our present endeavour concerns the progress of notetaking within lectures.

Since the lecture is here to stay, it therefore becomes mandatory for researchers to turn to more profitable problems such as how to make the method better in the accomplishment of its purpose and function. It is indeed advisable to heed Brown's (1978) suggestion that "rather than bemoaning the deficiencies of lectures, one should seek ways of improving their effectiveness" (p.4).

In so far as without notetaking of some form, the lecture itself has little value, if the lecture is to stay, then notetaking is surely here to stay.

CHAPTER 3

NOTETAKING

CHAPTER OUTLINE

3.1 INTRODUCTION

Research represented in Chapter 2 was concerned with the effectiveness of the lecture method. The studies described were designed to compare various teaching methods such as discussion, seminar, private study and various combinations of these with the lecture, the criterion measure usually being the amount of information students retained or recalled following instruction by particular methods. The conclusion reached was that the lecture method was no less effective than other methods for the transmission of information (Bligh, 1972; Dubin & Tevaggia, 1968; McLeish 1968). Hartley & Cameron (1967) suggested, in reaction to these broad comparative studies, that inappropriate techniques had been used to measure the efficiency of lecturing, arguing that measuring the amount of information uptake is a more legitimate way to assess lecture effectiveness.

Notetaking research thus evolved as an alternative route for the measurement of the effectiveness of the lecture method, attempting to provide answers to the question of how notetaking maximises the main purpose of lectures, namely, the transmission of information and its storage for further reference. This was a natural progression of the popular behavioural approach (at the time) to studying phenomena, which simply involved determining the effects of an observable independent variable such as "amount of notetaking" on observable dependent measures such as amount recalled or retained. As a consequence, research has been largely concerned with how much is learned and/or retained as a result of taking notes.

3.2 NOTETAKING ACTIVITY: CONCEPTUALISATIONS

Researchers have not been offered detailed conceptualisations for notetaking activity perhaps because it seems self defining. It is our opinion however that this lack of characterisation of the behaviour is responsible to some extent for

the predominantly functional view so pervasive in the literature. A conceptual analysis of the activity is therefore undertaken in this section.

All activity engaged in to produce notes constitutes the process. Notes are evidently a product not just of the motor processes of the nerves, muscles and hand, but also of cognitive processing. The processes include all the cognitive manipulations, which occur right up to the point of note production. The resultant is what we refer to as the processing product, the notes.

The cognitive processes that underlie and accompany notetaking activity have been largely neglected. The reason for this neglect of the cognitive accompaniment of notetaking behaviour is not that the necessity of such information has not been identified. A decade ago, Hartley and Davies (1978) pointed out the paucity of research in this area with the remark; "few investigators, if any, have commented on the process of note taking" (p. 207). Eight years on, it was further pointed out that "it is necessary to focus on the learner's cognitive processes during encoding" (Peper and Mayer, 1986). The picture still has not changed, for in 1988, Kiewra laments the unfortunate situation where little is known about how cognitively oriented organismic variables directly affect notetaking. It has become a matter of urgency to seriously consider doing for lecturing and notetaking what Hartley and Marshall (1974) advised i.e. "to dissect the process and to simplify it almost beyond all recognition in order to get at the basic fundamentals" (p. 233).

The scantiness of research on the processes of notetaking contrasts with research emphasis given to notes-as-product. The literature reveals numerous studies which have been concerned with evaluating the functions of written notes. In none of these studies has the concept of notes as a processing product been put forward. Accordingly, a justification or rationale for such a conceptualisation is desirable.

First, the notetaking literature shows confusion in the use of certain key terms. Hartley & Davies (1978) point out that two of the main reasons why students

take notes are concerned with the process of notetaking and with the product. Using the term process to identify notetaking behaviour is not helpful, and the term activity may be a better substitute. The activity of notetaking can then be seen as involving cognitive processing of various kinds and levels. Such cognitive processing has frequently been termed encoding (Di Vesta & Gray, 1972; Rickards & Friedman, 1978; Annis & Davies, 1975). Again, it is suspected that the over simplification of the activity inherent in the descriptive tag encode is responsible for the virtual black box model embodied in both qualitative and quantitative theories of notetaking. Thus researchers behave as though there is only one macro-stage between hearing the lecture and and the final product which appears in students notebooks. This step then seems a reasonably obvious one unworthy of investigative effort. Such conclusions were perhaps unavoidable given the preoccupation of early notetaking research with the product of notetaking activity.

Two potential functions of notetaking have been identified; the process or encoding function and the product or external storage function (Di Vesta & Gray, 1972; Seward, 1910). These will be described presently, but it is first necessary to examine those processes stipulated to have an encoding function.

3.3 NOTETAKING PROCESSES

Although empirical investigations are few, there is a large consensus concerning the nature of encoding and in the fact that encoding accompanies notetaking activity. Di Vesta and Gray (1972) aver that encoding "involves the learner transcribing whatever subjective associations, inferences and interpretations that occur to him while listening" (p.8). Fisher and Harris (1972) view encoding as a process, "in which the learner reorganises the input data, and ... transforms the data to make it his own" (p.321). Howe's (1972) opinion is similar to that of Fisher & Harris: it involves coding, integrating and transforming information. Aiken et al. (1975) maintain that processing lecture content involves interpreting, inferring, condensing and paraphrasing (p.439). Weener (1974) proposes

that "while listening....., the student transforms the presented message in ways which can be described as associational, conceptual and inferential"(p.62). He labels the various types of notes that represent these various type s of transformations. Chunking, coding and organising of the message result from conceptual transformations; rules and inferences show inferential transformations. While this is elegantly characterised, Weener's transformations as identified are not sufficiently discriminated from the types of notes they are supposed to produce.

In contrast to this more general view of encoding, Carter & Van Matre (1975) feel that notetaking is "more likely to resemble verbatim transcription of the sort that occurs when copying frames in programmed instruction" (p.900). It appears they do not share the view of other researchers that a good deal of processing accompanies notetaking. However, Rickards & Friedman (1978) disagree with Carter & Van Matre (1975) believing that notetaking is likely to involve some processing beyond verbatim learning. Rickards & Friedman identify the kind of processing as "organising information and/or sifting out relevant material" (p.136). More recently, Barnett et al. (1981) stated that the processing accompanying notetaking involves paraphrasing, selecting, and summarising relevant information.

From this overview it is seems that the processes and processing subsumed under the term encoding have been largely declarative. Research with actual subjects taking notes purposefully to investigate the processes which people deploy has been very limited.

3.3.1 Investigations Of Notetaking Processes

Out of the large body of research on notetaking, only five studies were located which were devoted to the process of notetaking . Even these were focused on the processing product, analysing student notes in the hope that "what" was recorded would somehow reflect the "how" of the activity.

The first study is that of Hartley and Cameron (1967) whose stated aim was the

assessment of the amount of information stored in students' note books. They used a 52-minute lecture on psychology in a live classroom. The lecture had been divided into ten minute sections (segments) for purposes of later analysis. The criterion measure was the number of information units recorded by students per segment of the lecture. The percentage of ideal units recorded (i.e. ideas with high note worthiness) was also calculated. It was found that "approximately one-third of what was said was transmitted to note books from the lecture" (p. 33). Analysis of the ideal units showed that there was a high percentage of agreement between student notes and the lecturer about points of major importance. There was also high between-student agreement on what was noted. "References, definitions, names, and words written upon the blackboard were noted by at least three-quarters of the students."

Maddox and Hoole (1975) in a study designed to replicate the Hartley and Cameron (1967) study, investigated performance decrement during expository lectures. Subjects listened to a live lecture on South East Asia and took notes. The information units in notes were then analysed. It was found that on average the class took down 52.2% of ideal notes. Women were found to take fuller notes than men. Occasions when notes were not recorded were found to be when (i) the lecturer stood away from his notes, (ii) a joke was made, (iii) questions were asked by students and a discussion ensued, and (iv) visual aids were used. It was found that only 0.05% of the notes were erroneous. 100 out of the total 190 units were recorded, 83 were omitted and 6 were partially recorded.

Howe (1970) reasoned that a useful approximation to direct observation of encoding processes might be provided by asking subjects to take notes selectively on the elements of the passage they considered important. One week later, the subjects were given a free recall test. Both the meaningful content of the original notes and goodness of recall were measured. It was found that the mean number of segment items in students' notes was 10.88 out of 20, while the average number of items that appeared in both notes and recall was 3.65. The mean number of words in notes was 32.81, while the mean number of words in the recall attempts was 50.73. There was a significant correlation between

meaningful recall of segment items and verbatim recall ($r = .87, p < .01$). The correlation between the "efficiency index" and meaningful recall was significant, ($r = .53, p < .05$). The efficiency index assumes that the fewer the words used to record an idea in the notes, the more "efficient" the notetaking. The index suggests that notes provide a useful indication of how the materials were processed and encoded - fewer words in notes being evidence of better processing.

In another study, Howe (1970b) had subjects hear a 160-word passage 5 times and attempt written recall 4 times. The correlation between meaningful recall and verbatim recall scores for each of the four trials were, T1 $r = .89$; T2 $r = .79$; T3 $r = .76$; T4 $r = .75$, in each case $p < .01$. His conclusion was that the way material is encoded is fairly stable and permanent.

Nye (1978) analysed in detail student notes from a 42-minute lecture on introductory psychology given at the rate of 84 words per minute. Notes were scored for number of words, main points, minor points, neatness, legibility and number of mistakes. The results showed that 69% of the main points were recorded, warranting the remark by the researcher that "the general standard of the students' notes was good" (p. 197). Forty-eight percent of the total lecture content was recorded, a figure close to the estimate of Maddox & Hoole (1975), but higher than findings by Hartley & Cameron (1967). First-year students were found to take fewer notes and with fewer main points. Like Maddox & Hoole, Nye also found that women used more words and recorded more main and minor points in notes. College experience was found to be significant for males but not for females: thus, males who had been at college longer noted more main and minor points. High correlations were reported between the number of words in notes and the number of points. Small but significant correlations were also found between final marks on the course and number of words in notes i.e. more notes leading to better marks, a finding in direct contradiction to Howe's conclusion regarding efficiency of notetaking. It was also found that the students who followed the practice of taking rough notes then re writing them later actually scored 5.4% less on the final mark.

Locke (1977) in a study aimed at investigating the completeness of a typical

student's notes, obtained and analysed lecture notes of 181 students in 12 different courses. He found that 50% of spoken and about 80% of written material (e.g. on the chalkboard) was recorded in notes. This finding is consistent with those of Maddox & Hoole (1975), and of Nye (1978) with respect to the probability of lecture material appearing in students' notes. For material not written on the board, there was a positive correlation between lecture note completeness and course grades, a finding similar to that of Nye (1978). It was also found that errors of commission were very rare (cf. Maddox & Hoole (1975). Unlike the findings of Maddox & Hoole (1975), there was no drop in lecture note completeness from the first 20 minutes to the last 10 - 30 minutes although there were signs of an early peak and of a spurt towards the end. In Locke's opinion, this result signifies that the common belief of notetaking performance not being sustainable for the entire lecture period is unwarranted.

At the end of this section of the review, the picture emerging is of one in which about half of the total amount of important information emitted/transmitted is recorded in notes. The material noted is usually of high importance. The kinds of information noted appear to be stable, and information noted stands quite a high probability of being recalled whereas the probability of recalling un-noted information is very small indeed.

Questions left unanswered revolve around the nature of processing that goes on to produce these notes. The hope that studies using the content or structure of notes will somehow inform on the kinds of encoding that take place has only partially been realized. The present writer believes that analysing notetaking activity from an information processing perspective will make this goal more attainable. This will in turn enable the activity to be more finely specified so that ultimately, the most effective and efficient strategies may be isolated.

3.4 FUNCTIONS OF NOTETAKING

The bulk of the studies of notetaking to date have been interested in finding out why students take notes. Anderson and Armbruster (1986), quoted Seward (1910), as having proposed two functions of notetaking;

> "...to preserve a record of what a lecturer has said, for the sake of future use ... for purposes of review. Yet that usefulness is not their chief value ... The practical value of our notes will take care of itself as a matter of secondary importance, if we devote ourselves wholly to their main purposes - to make us alert, clear headed and responsible as we listen to a lecture, and to serve as a ready test of the firmness of our grasp", (p.9).

Seventy-seven years on, these functions identified by Seward (1910) are still the hypothesised functions of notetaking. It is now common to label them the "external storage" and "encoding" or process functions. The external storage hypothesis postulates that notes act as an external storage mechanism the value of which lies in the provision of a resource for later use and study, such as review before an examination. The encoding hypothesis argues that the activity of writing down notes helps the note taker learn and remember information. Subsumed under the encoding hypothesis are the ideas that the notetaking activity can serve to (a) increase an individual's attention to the material (Howe, 1975; Peper & Mayer, 1978), (b) ensure that effort is made at encoding (Peper & Mayer, 1978), and (c) allow the learner to relate the presented information to prior experiences (Wittrock, 1974).

There has been an extensive preoccupation in the literature with identifying which of these two functions is more important empirically. The encoding function of notetaking has often been seen as the more important of the two functions (Seward, 1910; Di Vesta & Gray, 1972).

Studies of the encoding or process function attempt to answer the question of whether the activity of notetaking aids recall, and generally contrast the recall, retention or achievement of students who take notes against those who take no notes. Strictly therefore, their focus is not on the process of notetaking, but rather on the product of the activity with notetaking itself having the role of a structural classifying variable. The processes that are given the vague label encoding involve processing at different levels or hierarchies. In line with this reasoning, studies of the process function are concerned with evaluating notes as the 'processing product' of notetaking activity.

This processing product, i.e. the notes, can also be reprocessed at review. Again, the mechanisms of this reprocessing have not been expounded. Rather studies operate at the more macro-level of comparing review versus no review conditions. It could be profitable at some point to investigate the reprocessing that accompanies review to find out what forms it takes and the consequences for recall.

3.5 INVESTIGATIONS OF THE PROCESS OF NOTETAKING

Investigations concerning the process of notetaking can be classified into those of; 1) function, 2) qualitative differences; 3) factors affecting processing. The method employed in the assessment of the function and qualitative differences commonly involves identifying differences in performance usually on recall tasks from subjects asked to take notes or instructed not to. In a third class of studies, the concern has been with highlighting the effects of various factors e.g. speed of delivery, or information density on processing and processing product (i.e.notes) and eventually on recall.

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3.5.1 Notes Versus No Notes

The greatest amount of interest as reflected by the number of investigations devoted to the issue has been with the question, of which is more important, notes-as-product or the processing itself? Put another way, what is the relative benefit for comprehension and recall of noted and unnoted information?

In one of the earliest and most extensive reviews of research in the area, Hartley & Davies (1978) located 35 studies which examined the above question. In seventeen of these studies, a significant difference in favour of notetaking was found. Sixteen of the studies reported no significant differences and in two studies note taking was found to produce an actual decrement in recall. In an updated review, Hartley (1983), revised the figures to 34 studies favouring notetaking and 19 findings of no significant differences. In 4 studies notetaking was found to hinder recall.

In a more recent review, Kiewra (1985a) listed 33 studies which favour notetaking with 21 showing no significant differences and 2 studies which found notetaking unfavourable for learning. There is thus a consistency across these three reviews to the effect that taking notes of some kind will have positive consequences for learning. A common criticism levelled against the studies on which this evidence is based, is that assessing the benefits of notetaking was usually confounded with reviewing making it difficult to state whether the observed differences were due to encoding processes alone. Furthermore, both the Hartley & Davies, and the Kiewra reviews included notetaking from various modes of presentation. For his own review, Hartley (1983) gives the figures as; 38 studies with audio presentation, 12 with text presentation, 4 with video presentation and 3 using film and film-strips.

A contrasting picture is provided in a recent paper by Anderson & Armbruster (1986). In a review of experiment-only studies,and excluding those studies whose mode of presentation was text-based and/or those which gave students time to review, Anderson and Armbruster showed that while 10 studies

provided support for notetaking, 14 failed to do so. Nine studies that used a live lecture setting were reviewed separately. Of these, only 3 showed support for notetaking. Overall therefore, 40% of the studies reviewed favoured notetaking, while 60% did not. Note that the research in this latter group includes studies that found no significant differences as well as one that found notetaking to be counter productive. The reviewers conclude that "clearly ... any effect of note taking on encoding is rather difficult to demonstrate, especially in live classroom settings" (p. 10).

The review by Anderson and Armbruster is useful because the heavy confounding influence from various sources is at least put in proper perspective. But one wonders if such constrained treatment is not too artificial especially as even their review contained studies of notetaking from various media e.g text, audiotapes, videotapes and films, if these studies were experimental. For further criticism of dependence on experimental study data see 3.5.2(c). They argue that although notetaking from various sources may involve different kinds of processing, this knowledge can still inform our understanding of notetaking in the specific lecture context. According to Anderson and Armbruster, the studies that provide support for notetaking include the following; Barnett, Di Vesta and Rogozinski (1981), Berliner (1969), Di Vesta and Gray (1972, 1973), Maqsud (1980), Peper & Mayer (1978, 1986), Crawford (1925b) and Weiland & Kingsbury (1979).

In the present review which includes experimental and naturalistic studies involving various presentation modes, 31 studies were found reporting enhanced performance for the notetaking groups. In 23 studies no significant differences were found, while in two studies notetaking was reported to hinder performance (see Table 3.1).

TABLE 3.1

STUDIES OF THE PRODUCT OF PROCESSING

		FINDINGS		
Year	Researcher	EP	NSD	HP
1923	Jones	X		
1923	Jones		X	
1925b	Crawford	X		
1925b	"		X	
1953	Ash & Carlton			X
1956	Fryberg		X	
1958	McClendon		X	
1959	Eisner & Rhode		X	
1962	Noall		X	
1963	Pauk		X	
1968	MacManaway		X	
1969	Berliner	X		
1969	McHenry	X		
1970b	Howe		X	
1970	Peters & Harris	X		
1971	Berliner	X		
1971	Todd & Kessler		X	
1972	Berliner	X		
1972	Di Vesta & Gray	X		
1972	Peters			X
1973	Di Vesta & Gray	X		
1973	Fisher & Harris	X		

Key:
EP = Enhanced Performance
NSD = No Significant Difference
HP = Hindered Performance

TABLE 3.1Cont'd

Year	Researcher	EP	NSD	HP
1974a	Fisher & Harris	X		
1974b	Fisher & Harris		X	
1974	Baker, Baker & Blount	X		
1974	Baker et al.		X	
1975	Annis & Davis		X	
1975	Aiken, Thomas & Shennum	X		
1975	" " "		X	
1975	Carter & Van Matre		X	
1975	Gilbert		X	
1977	Fairbanks & Costello	X		
1978a	Annis & Davis	X		
1978b	Annis & Davis	X		
1978	Nye	X		
1978	Peper & Mayer	X		
1978	" " "		X	
1978	Rickards & Friedman	X		
1978	Thomas	X		
1979	Bretzing & Kulhavy	X		
1979	Dyer, Riley & Yekovich	X		
1979	Riley & Dyer		X	
1979	Weiland & Kingsbury	X		
1980	Glover, Zimmer, Ronning & Peterson		X	
1980	Maqsud	X		
1981	Annis	X		
1981	Barnett et al.,	X		
1981	Bretzing & Kulhavy	X		

Key:

NP = Enhanced Performance
NSD = No Significant Difference
HP = Hindered Performance

TABLE 3.1Cont'd

Year	Researcher	EP	NSD	HP
1981	Norton	X		
1984a	Kiewra		X	
1984b	Kiewra	X		
1984	Kiewra & Fletcher	X		
1985	Einstein, Morris & Smith	X		
1985c	Kiewra		X	
1986	Peper & Mayer	X		
1986	Peper & Mayer		X	
Total		31	23	2

Key:

EP = Enhanced performance

NSD = No significant difference

HP = Hindered performance.

In one of the earliest investigations to use live lectures for comparing notes versus no notes, Crawford (1925b) carried out seven experiments of which three were concerned with the question of whether notetaking was better than non notetaking. In all three experiments the mean test scores for the groups with notes was significantly better.

In another study, Crawford (1925a) provided correlational support for the process of notetaking. The studies involved seven classes and a total of 211 students. Quizzes were given based on material covered in the lectures. The time interval between lecture and quiz varied from two to thirty-five days. Students' notes were also scored for quality. Final examination marks as well as scores on term papers were in the correlational analysis. Five groups were tested with an essay type free recall task, one group was given an objective completion test, while another group answered analytical questions. The correlations between points correct in notes and those correct in the quizzes ranged between .36 and .66, while correlations between points vague in notes and those vague in quiz range between -.13 to .36. It was noted that "full, clear and definite notes such as were scored right were much more closely related to quiz success than brief, sketchy, or indefinite notes which were scored as vague" (p. 285). Crawford found that the total number of points scored correct in notes in one lecture was positively correlated with success on the course as a whole. Crawford (1925a) concluded that taking notes on a point does not guarantee its being recalled at the time of the quiz, but failure to take note of it very greatly decreases its chances of being recalled. Similar findings are reported by later studies.

More recently, Kiewra (1984b) for example, reported similar findings. Kiewra analysed 10 students' notes over a four-week period during which subjects attended four fifty-minute lectures on learning to learn. The subjects took a fifty-minute multiple choice examination (Exam 1) in the fifth week. Five weeks later there was another examination (Exam II) on the rest of the course, which did not re-examine material covered in the first examination. Notes were scored for total number of points or ideas recorded. It was found that the total number of points was not significantly related to the first examination

(Exam 1). Note completeness was found to correlate significantly with Examination 1 scores (r =.78) and also with the final course grade which was the average of the two examinations, (r =.86). Students were found to respond correctly to lecture-related items only 34% of the time if the pertinent information was omitted from their notes, but 78% of the time if present. This contrast is consistent with findings from other studies concerning the probability of recalling noted and unnoted information. Howe (1970b) found the corresponding probabilities to be .47 and .05. For Aiken, Thomas & Shennum (1975), they were .47, and .12, while for Bretzing and Kulhavy (1981), the probabilities were .58 and .15.

Di Vesta and Gray (1972), in a study whose aim was to determine the effect of notetaking on later recall, had 120 subjects assigned randomly to one of 24 experimental conditions. The subjects listened to three taped 5-minute passages of 500 words each, during which some subjects either took notes or were disallowed from so doing. Further, some groups reviewed their notes during a five-minute interval between passages, while other groups took a filler test. At the end of the experiment, a free recall test was scored for volume of recall (i.e.total number of words) and number of correct ideas. The number of items correct on a multiple choice test provided a performance measure. Subjects who were allowed to take notes recalled significantly more ideas (Mean = 12.0) than did subjects not permitted to take notes (Mean = 10.6). The scores on the multiple choice test also showed that the effect due to notetaking was significant. In a later study which incorporated notetaking into the design of two experiments, Di Vesta and Gray (1973) found a significant delayed or "sleeper" effect due to notetaking in so far as they did not find significant differences on an immediate test.

Results from these experiments and the others reported in this section show that more is recalled when notetaking is permitted or instructed, but they fail to provide explanations for the beneficial effects of notetaking. The reasons for this may be connected with the methodologies of the studies themselves which have been criticised for being inadequate (Hartley & Davies, 1978; Anderson & Armbruster, 1986).

3.5.2 Design Limitations In Studies

a) The most common design limitation is confounding the effects of notetaking with the effect of reviewing notes prior to testing. In many studies there has been no attempt to isolate these two factors.

b) All the studies measure the amount of information retained more or less immediately on the assumption that this is the most appropriate, if not the only measure to use. This does not seem to be the case in live classrooms where immediate recall of the information is neither the lecturer's intention nor the students' major reason for taking notes.

c) A third weakness in these studies is the doubtful relevance of the lecture materials used. Most suspect are the experimental studies whose complementary weakness is the short time given to interaction between the learner and material. Live lectures usually last up to fifty-minutes, so that experiments in which subjects have to hear, listen, or study material for ten minutes or less seem unreal and quite likely not purposeful to the subjects. Recently, the call has been made for studies with more ecological validity (Kiewra, 1988).

d) Lastly, in practically all note taking studies, there seems to be a simple equation between noting ideas and comprehending them merely because they are recalled. Comprehension is obviously the desired intention in lecturing yet very few studies have attempted to investigate how understanding translates into notes or eventually into comprehension and recall let alone into substantive learning and raising of knowledge and skills. Poppleton and Austwick (1964) observed in comparing notetaking at two age levels that both grammar school pupils as well as postgraduate subjects had noted the key points in the programme. However, there was no relationship between noting and understanding

for the younger pupils. Eisner & Rhode (1959) also graded subjects' essays for understanding, with little difference to their conclusion of no significant difference between notes and no notes groups. Studies which claim no differences are also not exempt from flaws, being as suspect as those that do. For example, Ladas (1980) criticised Howe (1970b), Fisher & Harris (1974 a & b), Fryberg (1956), Eisner & Rhode (1959), Aiken et al. (1975), and Kiewra (1984a), for much the same methodological inadequacies. He declares that for the two studies which found notetaking to be counter productive (Ash & Carlton, 1953; and Peters, 1972) the results should be interpreted as supporting the encoding hypothesis since the reason given for the negative findings were probably due to unnaturally rapid presentation rates (146 and 202 words per minute).

3.5.3 Qualitative Differences

In an attempt to be less quantitatively inclined, other studies have tried to show that notetaking activity involves and produces qualitatively different outcomes. Studies by Peper & Mayer (1978, 1986) and Maqsud (1980) fall into this category. Peper & Mayer (1978) did not find notetaking to result in better overall performance but a statistically reliable interaction between notetaking treatment and type of recall item did occur. The notes group recalled more format and structure items and the no-notes group more summaries. Maqsud (1980) in two experiments, had college students, classified as "short" or "long" note takers, listen only or listen with note taking to a 2,200 word audiotaped lecture presented at 110 words per minute. Those subjects who took brief notes recalled more than those who took detailed notes. Maqsud suggests that short and long note takers engage in qualitatively different activities. Howe (1970a) tendering explanations for these qualitative differences evident in notes suggested that short "efficient" note takers may parse and summarize a segment of lecture information then search memory to check if they already have a word or word phrase to represent that summary. If they do have such a label it is re-

corded. Long note takers on the other hand might be less likely to organise and search memory, and instead record a more literal representation of the information (Anderson and Armbruster, 1986). But surely a number of other factors must influence what is noted?

3.5.4 Factors Affecting Processing And Processing Product

Factors within the learner will be self-evident by this stage. Research also provides evidence that processing is as affected by factors within the message itself e.g. information density, presentation rate, structure or organization of material, and cues in the message. As a third group of factors, student goals and objectives in taking notes may be expected to be important. They may be expected to influence both prior and within lecture disposition of the student, particularly the quantity of transfer of information from "understanding" to "comprehension" that is from working memory to long-term store.

3.5.4.1 Factors In Message

Aiken et al. (1975) investigated the relevance of three of these factors: speed of presentation, information density and spaced versus concurrent notetaking. Two lectures, one denser than the other (206 vs. 106 idea units) were presented at two rates (240 words per minute vs. 120 words per minute). In both cases, spaced notetaking was superior to parallel or concurrent notetaking. In addition, both speeded conditions produced terse notetaking and inferior recall to that from normal speech. Finally, high density interfered with recall of material but only for un-noted material. As remarked earlier, speed of presentation (146/202 words/min) has been held responsible for the negative results reported by Peters (1972) where significantly more correct responses were made by those not engaged in taking than by those taking notes.

Di Vesta and Gray (1973), together with Bretzing & Kulhalvy (1981) provided information in respect of the effect of structure or organization on recall, but not on notes per se. Di Vesta and Gray found that the number of ideas recalled was significantly influenced by the thematic organization of the material. In the first experiment, the mean number of ideas recalled by the three treatment groups were; continuous, related theme, mean = 27.33; discontinuous, related theme, mean = 30.83; and discontinuous, unrelated theme, mean = 43.20. In the second experiment the results were similar. Thus the more disjunctive the material the greater the number of ideas recalled. These results are interesting and on the face of it question the assumption that lecture material ought to be "well organised" with a theme running logically through all of the lecture.

Bretzing & Kulhavy (1981) also set out to investigate the interaction between passage style, notetaking and recall, but were only partially successful. They found that individuals who took notes from informal text were more likely to paraphrase material in notes than those reading formal discourse. With regard to recall, it was found that students who read the low formality version of the passage recalled significantly more idea units than those who read the high formality version. These results therefore indicate that characteristics of the stimulus material are related to recall and the types of notes produced.

Some attempts have been made to check the effects on recall of lecturer cues. Moore (1963) for example, using two treatment conditions of cueing using raised coloured cards to signal important ideas, and uncued (normal) notetaking , found that the cued group performed better. Unfortunately, the exact nature of interaction between lecturer cues and notes produced was not considered even though the analysis could have provided valuable insight.

Another aspect of the lecture message which influences both notes-as-product and recall is the provision of hand-outs. Hartley (1976) found that the mean number of words noted doubled in the absence of a hand-out, and that there was a significant gain in recall by the group which had a hand-out. In another experiment Hartley (1976) found that the structure of the hand-out produced

differential effects on notes produced but not on recall. Students took more notes on spaced hand-outs, (mean = 517 words), than on full hand-outs, (mean = 347 words). Howe & Godfrey (1977) highlighted the interaction between characteristics of the stimulus material and factors within the learner observing that a hand-out helped the recall of poor note takers but hindered that of good ones.

3.5.4.2 Factors In The Learner

Factors located within the learner which have been shown to influence notetaking and recall include familiarity, ability, memory span, gender, personality and age.

Peper and Mayer (1978, 1986) addressed the issue of familiarity with lecture content, reaching the conclusion that when subjects are unfamiliar with lecture content, notetaking is not only useful, but more notes are recorded. In their 1978 study, the relation between mathematical ability and notetaking was also investigated. With lecture material on computer programming it was found that the benefit of notetaking was stronger for low ability subjects. They suggest that for low ability subjects notetaking encourages an integrative encoding of material, whereas, high ability subjects have developed strategies of using active, integrative encoding without recourse to notetaking type activities. Thus the net effect on notetaking of familiarity and ability seems quite similar.

Einstein, Morris and Smith (1985) used measures of ability such as the GPA (grade point average) and a verbal scholastic aptitude test to distinguish between the notes of more versus less effective/successful learners. They found that, (i) less successful students experienced the lecture as more difficult to understand, (ii) successful students recalled more propositions than did less successful students, and (iii) successful students recorded more propositions as well as more propositions of high importance than did less successful students.

Another index of ability which has been incorporated into some studies of the process of notetaking is memory span/memory ability. Di Vesta and Gray (1973), like Berliner (1969) found that subjects with "poor" memory spans made higher test scores than those with "good" memory spans when they had been engaged in notetaking. This finding is consistent with those of Peper & Mayer (1978, 1986) described earlier.

It seems fairly evident from these studies, that ability of one kind or another influences what is noted and subsequently recalled. Interesting from a cognitive view point would be how these various ability indices actually mediate the process of producing notes. A study by Kiewra & Benton (1988) takes this direction, reporting that the amount of notes taken (i.e. number of words, complex propositions and main ideas) is related to the ability to hold and manipulate propositional knowledge in working memory, as well as to recall.

What seems surprising is that language ability has not been more extensively investigated (cf. Berliner, 1969) when factors such as aptitude and memory span have been shown to be implicated in notetaking and performance. Language ability was in fact incorporated into the design of Study 2 on notetaking processes in the present thesis.

Again, few investigators have looked at notetaking and "personality". Peters (1972) reported an earlier investigation (Peters & Harris, 1970) in which only one out of several (unspecified) learner personality variables was found to interact significantly with notetaking. Subjects who scored low on a measure of intolerance for ambiguity (Budner, 1963) performed poorly when not allowed to take notes while there was no difference in performance for subjects high on the intolerance measure, whether or not they were allowed to take notes.

In a more satisfactory study, Di Vesta & Gray (1972) similarly investigated the interaction of notetaking and learner personality as identified by the following variables: achievement anxiety, intolerance of ambiguity, social desirability, dogmatism and locus of control. It was found that out of five personality measures, only one (social desirability) was significantly related to number of

ideas generated at recall. On the other hand, there is no prima facie reason why these particular personality factors ought to relate to notetaking. Even though Di Vesta & Gray (1972) found that subjects with a greater desire to please and conform socially engaged in greater notetaking behaviour which resulted in better performance, having a plausible theory to account for the finding is a different matter.

Both age and gender have also been implicated in notetaking. Poppleton and Austwick (1964) suggested that the reason for the difference in performance on a criterion test between grammar school pupils and post graduate subjects might be the relative inexperience in notetaking of the 12 - 13 year olds. Unlike Poppleton & Austwick (1964), Nye (1978) and Hartley & Marshall (1974) report different findings. First-year college students in Nye's study took fewer notes and fewer main points. It was also found that for males in the sample, experience i.e. number of years at college was significantly related to the extensiveness of notes i.e. both more main and more minor points. Similar findings have also been reported on gender and notetaking by Hartley & Cameron (1967), Tood & Kessler (1971), Fisher and Harris (1973, 1974a), Maddox and Hoole (1975), Hartley (1976), Hartley & Trueman (1978), and more recently, by Kiewra (1984a). Hartley and Davies (1978) point out that sex differences in notetaking seem to be so common place that it should be mandatory for researchers to check for them, and they are in fact examined in the studies to be reported in this thesis.

3.5.4.3 Learner Objectives

In addition to characteristics of the message, and factors within the learner, external goals can also influence how notes are taken during lectures. Students generally record what they consider to be important because they expect to be tested on main ideas or key points. Research evidence supports this, with studies showing that students record between 50% and 70% of "ideal" notes (Locke, 1977; Crawford, 1925a; Maddox and Hoole, 1975; Hartley and

Cameron, 1967; and Nye, 1978). It has also been demonstrated by Weener (1974) that more specific test information which results in different test expectancies may result in observable differences in notetaking behaviour and recall. Weener (1974) reported a study in which the effect of anticipated recall mode and recall interval expectancies on notetaking was investigated. He found that the three different expected recall modes (multiple choice, essay and verbal presentation) did not produce significantly different amounts of notes. This finding agrees with that of Hakstian (1971) and of Rickards & Friedman (1978). However, Weener (1974) found that the group which expected a test one week later took double the amount of notes taken by the group which expected an immediate test. The group with more notes (the delayed expectancy group) performed worse than the immediate expectancy group on the immediate and on the delayed essay test. Weener reasonably argues that a delayed test expectancy made students take notes mainly for the purpose of external storage whereas an immediate test expectancy produced fewer notes but more internal transformations or real time encoding.

Closely tied to learner goals or objectives are issues of relevance of lecture material: "is it going to be examined?" as well as college policies on courses. Research on approaches to learning suggests that this is a possibility. Courses that are assessed by methods other than examinations have been shown to produce different types of understanding (Ramsden, 1979; Biggs, 1976) and by extension perhaps "levels" of notes.

3.5.5 Levels Of Processing

According to the concept of levels of processing, information is processed in a hierarchy of stages, from an analysis of physical or sensory features to a "deeper" semantic analysis involving the extraction of meaning. The level of analysis performed on incoming information determines what gets stored in memory. A deeper, semantic processing of information is assumed to be necessary for long term memory.

The implication of this for the present research is that students could take notes of a kind involving processes at any level of processing and such notes should bear characteristic features of that particular level. The level would further be co-determined by characteristics of the lecture together with the student's goals or purposes for attending the lecture and obviously his/her degree of familiarity with the content. Studies that have attempted to investigate levels of note taking include those of Bretzing & Kulhavy (1979), Barnett et al. (1981), and Kiewra & Fletcher (1984). Bretzing & Kulhavy (1979) instructed subjects to engage in summarizing, paraphrasing, verbatim notetaking or in a letter-search task. These various activities were intended to reflect processing at progressively shallower levels, with the letter-search group task serving as the control. They found that students who took notes which required them to summarize or paraphrase, recalled significantly more than those who took verbatim or letter-search notes. Subjects who took verbatim notes scored significantly lower on tests of comprehension. Least effective retrieval occurred in the letter-search condition, but no significant differences were found between the summary and paraphrase group. This finding makes it questionable whether summary and paraphrase involve characteristically different types of processing or whether they both occur at the same cognitive "level". On the other hand, it could be that instructing subjects to engage in different levels of processing may not be sufficient to make them do so, particularly if other within-learner factors and learner goals are taken into consideration. It is suspected that this may have been the case with the finding by Barnett et al.(1981): their hypothesis that elaboration which involved more (deep) processing would lead to more learning (remembering) was not supported in either of two experiments.

Kiewra & Fletcher (1984) gave four groups of subjects different instructions to take, (a) typical notes, (b) conceptual notes, (c) relational notes and (d) factual notes between segments of a 22-minute tape recorded lecture on Attention. It was found that notetaking behaviour was minimally manipulated because subjects seemed not to have followed or been able to follow instructions closely. In particular, there was an inability to take relational notes, and the researchers suggest that this level/kind of processing is inappropriate for classroom notetak-

ing. The four groups did not differ significantly in respect of either notetaking or test performance, although students who noted more conceptual points did better than factual note takers on all levels of the test items (factual, conceptual and relational). Kiewra & Fletcher's conclusion in relation to the finding of no significant differences and in reaction to the marginal success of instructions on actual notetaking behaviour, is that notetaking needs to be manipulated more strongly and systematically, perhaps through training to produce any significant results.

In all of the studies of the process of notetaking, just five studies were located which involved training of any kind (Corey, 1935a; Palmatier, 1971; Bizinkaukas, 1970; Palmatier & McNinch, 1972; Driskell, 1976). Palmatier (1971) trained students in the use of the formal outline procedure, the three-column method, and the two-column method. The training was completed in four class periods during which subjects took, revised and studied their notes for ten minutes. This confounding of taking notes and reviewing, as discussed earlier, makes isolation of the effects difficult if not impossible. However, it was reported that there were no significant differences in quality of notes and knowledge gain among the different groups. A one-way ANOVA indicated significant difference among the four methods for recording essential content. This difference was interpreted to be in favour of the two -column method which was traditionally the method used in the college. It is possible therefore that the training and its reception reflected something other than experimental effects.

In conclusion, research findings on the process/encoding function of notetaking provide both quantitative and qualitative evidence that notetaking does "make a difference"(see Table 3.1). Subjects remember more (or different kinds of) main points if they take notes than if they listen without taking notes. Anderson & Armbruster however, (1986) add the following provisos. Notetaking helps only: (a) when the lecture situation is such that taking notes does not interfere with cognitive processing, and (b) when subjects are able to take the kind of notes that entail deep processing of the input information, or at least processing appropriate to the level of the criterion test. One may take issue with this second condition. Firstly, deep processing may not be necessary or

even possible under certain conditions, such as during continuous exposition or with limited background knowledge, and engaging in it may be counter productive. Secondly, processing for notetaking in Anderson's and Armbruster's conceptualisation is tied to examinations. However, tests often do not follow lectures in vocational courses or seminars/discussion meetings of academics but notes of a kind are taken. What could they possibly be used for? As a simple record/store of knowledge, presumably. This brings us to the next section of the review which is concerned with the more common, and visible function of notes and notetaking - the review function usually referred to as the product function in the notetaking literature.

3.6 THE PRODUCT/REVIEW FUNCTION

Along with encoding, the second commonly identified function of notetaking is that of external storage when notes are used as a resource for later study or review. To test the external storage hypothesis, researchers typically ask subjects to review their notes under contrasting conditions and the effect on recall is assessed. Studies which have investigated the review function of notes are shown in Table 3.2. Sixteen out of the 21 studies located provide data which indicate that review enhances performance. Fewer studies have investigated the review function than the process function of notes, but with clearer findings in favour of review. Of the 16 studies concerned with whether review can increase recall, Hartley and Davies (1978) found 13 whose findings support the external storage hypothesis, while in three studies there was no significant difference between groups that reviewed and those which did not review notes. No studies found review counter productive. Kiewra (1985a) located 22 studies of review function, 17 of which support the review of notes while 5 studies reported no significant difference between reviewing and non-reviewing.

Anderson and Armbruster (1986) surveyed 14 studies all of which provide some support for the usefulness of review on test scores. "Obviously", they remark, "researchers have found it easier to demonstrate the external storage hypothesis than the encoding hypothesis" (p. 23).

There is therefore a consensus in the research findings that note review is facilitative of improved test performance.

Although there is general agreement about the usefulness of reviewing notes, there still remains controversy over a number of other issues that pertain to review. For instance, review of subjects' own as opposed to lecturer-provided notes, the search for optimal conditions for review in terms of its placement between notetaking and criterion tests, plus the optimal length of time for reviewing. A number of studies have examined these questions but the state of this knowledge is still rather mixed.

Fisher & Harris (1973), for example, found that for immediate testing, taking and reviewing own notes was most effective. Taking no notes and reviewing lecturer-notes was in turn more effective than taking notes but reviewing lecturer-notes, or taking notes with mental review only. The no-notes-mental-review condition was least effective. These results imply that reviewing own notes produced superior recall over reviewing lecturers' notes. However, Fisher & Harris (1974) unexpectedly had results dissimilar to the findings of their earlier study. Gains from an immediate to a delayed test after a 10-minute review period indicated that review did not improve performance. The researchers remark that additional questionnaire data suggest that subjects' notetaking preference may have interacted with experimental conditions.

The study by Carter & Van Matre (1975) provides some evidence for the positive effect of reviewing own notes. Unfortunately they had no equivalent contrasting group using lecturer's notes for review, so that it is again difficult to infer which is really better. Annis & Davis (1975), as well as, Rickards & Friedman (1978) do however, provide clearer information about the relative benefits of reviewing own notes as opposed to lecturer notes. But Kiewra (1985b), and

Kiewra & Benton (1985) found that reviewing instructors' notes led to significantly higher achievement on factual items than did reviewing personal notes. In the Annis & Davis (1975) study, the group which took notes and reviewed their own notes performed significantly better than the group which had only lecturer's notes to review. The best performance in this study was by the group that reviewed their own notes plus the lecturer's notes. However, it could be argued that their performance was due to the additional length of review time they had, because this was not controlled. The issue of the optimal length of review has not been extensively or systematically researched although several notetaking studies have demonstrated significant positive external storage effects even when the review period was as short as 5 - 10 minutes (e.g. Annis & Davis, 1975 - 10 min; Carter & Van Matre, 1975 - 5 min; Fisher & Harris, 1973 - 10 Min; Howe, 1970b - 5 min, Rickards & Friedman, 1978 - 10 min). The belief that the more time subjects spend reviewing notes, the greater the gains in performance is pervasive, and Kiewra (1985b), and Kiewra & Benton (1985) using longer review/study periods lasting 25 minutes found review still effective. This belief is an off-shoot of the thinking about time-on-task (Carroll 1963). Carter and Van Matre amongst others contend that to be of maximum value, the review period (whatever the length) must be proximal to the test. However, there does not appear to be a study that has investigated optimal placement by systematically varying the location of the review.

In the experiment conducted by Carter and Van Matre (1975), subjects reviewed after the lecture for an immediate test and then took a one-week delayed test without further review. Unfortunately performance on the delayed test was not compared with that of groups which engaged in review both immediately and just prior to the test. It is obviously essential that such comparisons be made if the optimal timing for the review is to be estimated.

Howe (1970b) found that allowing subjects a 5-minute review period immediately after acquisition raised their 2-week delayed free recall over subjects who had no opportunity to review. Pauk (1974) also reported similar findings: students given 5-minute review time immediately after class recalled one-and-a-half times as much material as the group that had no review.

The optimal serial position for a single review effort still remains unverified.

TABLE 3.2

STUDIES OF THE REVIEW FUNCTION

		FINDINGS		
Year	Researcher	EP	NSD	HP
1925b	Crawford	X		
1953	Ash & Carlton	X		
1956	Fryberg	X		
1970b	Howe	X		
1972	Di Vesta & Gray	X		
1973	Di Vest & Gray		X	
1973	Fisher & Harris	X		
1974a	Fisher & Harris		X	
1974b	Fisher & Harris		X	
1975	Annis & Davis	X		
1975	Carter & Van Matre	X		
1977	Howe & Godfrey	X		
1978a	Annis & Davis	X		
1978b	Annis & Davis	X		
1978	Thomas	X		
1978	Rickards & Friedman	X		
1979	Bretzing & Kulhavy		X	
1980	Maqsud	X		
1981	Barnett et al.,		X	
1981	Norton	X		
1984	Kiewra & Fletcher	X		
Total		16	5	0

Key: EP = Enhanced performance
NSD = No Significant difference
HP = Hindered performance

Some studies of the review function of notes focus on congruence between notes taken and requirements of the criterion test. In general, the studies suggest that the greater the congruence between the information in notes available for review and the information required on the criterion test, the better the learning outcome (see Crawford, 1925a; Locke, 1977; Kiewra, 1985a, Annis & Davis, 1978; Maqsud, 1980; Kiewra, 1985b; Kiewra, 1985c; Kiewra & Benton, 1985; Fisher & Harris, 1973). But congruence between notes and test is only part of the consideration, observe Anderson and Armbruster (1986). They maintain that in addition to having the right information students must also process (encode) it in a transfer-appropriate manner, that is, in the way they will need to use that information in the criterion test. A levels-of-processing approach to review is suggested, which like encoding itself, sees review as involving processing at different levels something which should be evident in performance. Studies which concern processing during review include those by Carter & Van Matre (1975), Hartley & Marshall (1974), Barnett et al. (1981), Kiewra & Benton (1985), Kiewra (1983), and Shimmerlick & Nolan (1976).

Shimmerlick & Nolan (1976) investigated the relative effectiveness of reviewing notes at different cognitive levels. Subjects either merely listed or had to reorganise previously acquired textual material. Scores on the immediate and delayed free recall tests favoured the subjects who reorganised the acquired information into specified categories and who were assumed to have processed the material at a deeper level. However, Kiewra (1983) in a close approximation of the Shimmerlick & Nolan (1976) study was not able to replicate the findings; neither were Barnett et al. (1981).

To conclude the picture on review, there is evidence that an important function of notes is their availability for use as review material or resource. Reviewing notes prior to a criterion test is highly likely to improve performance, when notes contain the information that may be required on the criterion test. Anderson & Armbruster (1986) aver that in most cases, this probably translates as the more information the better. However, little is known about optimum spacing of review.

3.7 PROCESS VERSUS REVIEW FUNCTIONS

In a few studies the relative importance of the encoding and the storage functions of notetaking have been compared. Table 3.3 lists six such studies and in four of them the review function was favoured while two studies supported the encoding function.

Kiewra (1985a) located 7 studies in the literature which have compared the process/encoding and the product/external storage functions of notetaking. Two of the studies favour the process function (Annis & Davis, 1975; Barnett et al., 1981), and five the external storage function (Howe, 1970b; Fisher & Harris, 1973; Carter & Van Matre, 1975; Rickards & Friedman, 1978; Kiewra, cited in Kiewra, 1985a).

This line of research that compares the "benefits" of the process against those of review seems strange. For one thing, taking notes and reviewing notes are two different activities. Secondly, notetaking and note review serve identifiably different though complimentary purposes of encoding and storage. Research energies should be in the direction of finding out the most effective and efficient strategies involved in both producing notes and in reviewing them, so students may be shown or taught how to optimise both. This sort of information would also guide theory building of which there has been little.

TABLE 3.3

STUDIES COMPARING THE PROCESS & REVIEW FUNCTIONS

		FINDINGS		
Year	Researcher	PS	NSD	RS
1970b	Howe			X
1973	Fisher & Harris			X
1975	Annis & Davis	X		
1975	Carter & Van Matre			X
1978	Rickards & Friedman			X
1981	Barnett et al.,	X		
Total		2		4

Key: PS = Process supported

NSD = No significant difference

RS = Review supported

3 . 8 THEORIES OF NOTETAKING

All the research reviewed thus far can be conveniently classified in to two groups - qualitative and quantitative - though lopsidedly, in terms of the kinds of evidence sought or advanced. Quantitative studies, which out-number qualitative ones attempt to answer questions of notetaking in terms of how much more or less is recalled. On the other hand, qualitative studies arose out of a reaction to the implicit over simplification in the quantitative hypothesis of notetaking. Qualitative research tries to show that notetaking does not only result in more or less being learned, but rather that qualitatively different learning outcomes occur. It is our opinion that approaches are usefully complementary though qualitative theory can be faulted on the grounds that it is descriptive rather than evaluative and therefore less valuable in advancing theory.

3 . 8 . 1 Quantitative And Qualitative Theories Of Note Taking

Most investigations up until the latter half of the 1970's were preoccupied with the functions of notetaking. From this line of research emerged the quantitative and qualitative theories. Quantitative theory holds that notetaking allows the note taker to retain a greater or lesser amount of the information transmitted. Qualitative theory on the other hand stresses that note takers and non-note takers differ in the kinds of information retained.

Both theories are outcome (product) and function oriented, their essential concern being with how much and what kind of the noted information is recalled (e.g. whether conceptual or factual). These theories are limited in that they neglect the cognitive processing that precedes the creation of notes-as-product. Quantitative and qualitative theories although recognizing that notetaking behaviour serves a mathemagenic function (Rothkopf, 1970) have given this crea-

tive process little research attention. Neither were developments in information processing (Norman, 1978), schema theory, (Rumelhart & Ortony, 1977), discourse processing, (Kintsch & Van Dijk, 1983), or learning-to-learn (Brown, Campione and Day, 1981; Dansereau, 1985; Armbruster, Echols and Brown, 1982), all of which extend the known variety and types of encoding processes, taken up until well into this decade.

Yet another source of dissatisfaction with early theories has been their treatment of comprehension. Hartley and Davies (1978) reviewing a total of 80 studies of note–taking wrote that "All the studies assume that measuring the amount retained after a period of time is the appropriate (and only) measure to use" (p. 211). They observed that "the immediate recall of the information is neither the objective of the students attending the lecture nor of the lecturer in delivering it. Therefore immediate factual recall tests are inappropriate instruments with which to measure the efficiency of a lecture." There is a general tendency in the research to equate the recalling of ideas with comprehending them. Yet recalling ideas must surely be different from integrative comprehension. For example, one may "comprehend" everything in an easy lecture, yet recall little if the material was too obvious to be flagged as significant for encoding purposes.

The current research interest in teaching learning strategies that real people, students or experts use in executing tasks is only faintly represented in this area, with the manipulations (treatments) in early studies restricted to variations in notetaking and review (Di Vesta & Gray, 1972; Annis & Davis, 1975; Fisher and Harris, 1973, 1974).

Another limitation of earlier approaches is their widespread treatment of notetaking as an independent, activity whereas research in other areas of cognitive psychology has been pointing to the interactive nature of most mathemagenic activity, notetaking included (cf. Mandl & Schnotz, 1985; Haertel et al., 1985).

3.8.2 The Generative Model

Owing to the inadequacies of quantitative and qualitative theories, alternative approaches were later sought. The generative hypothesis, was first advanced in 1974 by Wittrock but essentially ignored for a few years. However, it offered a useful paradigm shift being more encompassing and reflecting newer thinking on the interactive nature of learning.

As a cognitive model of human learning, the generative model attempts to tie concepts in cognitive development, human learning/ability and information processing, to the influence of previous experience. The generative model is in keeping with the shift away from the associationist tradition towards cognitivism, where the learner and his or her processing strategies are the most important predictors of learning with understanding. The fundamental premise of the generative model is that people will generate perceptions and meanings that are consistent with their prior learning. The generative model holds that "learning is a function of the abstract and distinctive concrete associations which the learner generates between his prior experience as stored in long term memory, and the stimuli" (Wittrock, 1974). Learning-with-understanding is therefore a process of generating semantic and distinctive idiosyncratic associations between stimuli and stored information. Any learning activities or strategies which require learners consciously and intentionally to relate new information to existing knowledge are therefore in this sense generative. The most important cognitive processes involved in learning are the access and retrieval of prior experiences from memory, to relate to the presented information so as to generate meaning (cf. Mayer,1975). The model in effect places a burden on individual verbal ability for constructing semantic representations from the interaction of prior experiences with presented information. One learner will differ from another to the extent that their "prior experiences" are divergent.

Generative theory argues that qualitative differences between learners are not only real but central to learning. Accordingly, studies of learning in general and

note taking in particular have redirected themselves to unearthing and in some cases training the qualitative differences found in strategies and strategy deployment of learners and note takers.

In one of the earliest investigations of notetaking within this frame-work, Peper and Mayer (1978) conducted three experiments to determine whether subjects who take notes have different learning outcomes from those who do not. Using university graduates and a short video-taped lecture on computer programming they related advance organizers to notetaking and test performance. Peper & Mayer found that whether notes were taken had no overall effect on post-test performance, but it did have an effect on how well different types of questions were answered: note takers performed better on interpretive items, while no-notes subjects performed better on generation type questions which required translation of programmes written in English into FORTRAN. The point to note here is that these interpretation type problems were were those least similar to how the information was presented in the original lecture. The effect appeared stronger for low ability subjects. The researchers suggest that notetaking helps to activate a meaningful learning set for low ability students and encourages integrative encoding of material.

In another experiment, Peper & Mayer (1978) looked at note takers and non-note takers by analysing their recall protocols. It was found that the notes takers recalled more format and structure idea units and produced more intrusions, while the no notes group preferentially recalled technical units and had more 'vague' summaries. There was some evidence a) that the notes group had attempted to connect the new information with other ideas; b) that the notes group was more coherent in its recall pattern. Peper & Mayer conclude that the results show note takers performing better on far transfer tasks and non-note takers on near transfer tasks. They see this as consistent with generative theory: noting that note takers assimilate the new information to past experiences to form a broader learning outcome, while none note takers simply add new facts to memory and form narrower outcomes. These conclusions may need to be restricted to case unfamiliar material which was the status of the material in their experiments.

In a further set of experiments, Peper and Mayer (1986) attempted to isolate the effect of familiarity and notetaking on the recall of presented information. In the first of two experiments, using high school juniors with no relevant prior experience and a video taped lecture on the working of car engines, they found that the notes group performed significantly better than the no-notes group on a far-transfer test (problem solving). The notes group was marginally worse than the no-notes group on combined near transfer tests (syntactic verbatim recognition, semantic verbatim recognition and fact retention).

Results of a second experiment set up to determine how familiarity would influence the pattern of treatment and post test interactions found in earlier studies similarly supported the generative prediction that familiarity with subject matter is related to performance on different types of cognitive tasks. There were no significant differences for different notetaking treatments (continuous notetaking, and summary notetaking).

Jonassen (1984) attempted to broaden the scope of investigations within the generative model by providing a bridge between generative strategies and comprehension in terms of levels of processing. Two hypotheses were advanced for the study: i) as the level of generativity of processing increases, the recall and retention of information (especially that of high structural importance) should improve. ii) Varying the levels of generative processing should have a greater effect on recall of information than on recognition accuracy.

Using a passage in Educational Psychology, Jonassen placed college students in five treatment conditions of increasing generativity; read only (control), typographic underlining, generative underlining, review notetaking, and generative notetaking. It was found that the performance of the treatment groups improved as the level of generative processing increased, but only slightly and non-significantly. Immediate recall of information did not increase significantly as a function of the level of processing, but delayed recall of higher level information was improved by generative notetaking.

Kiewra & Fletcher (1984) in a study of the relationship between levels of notetaking and achievement identified four levels of processing involved in notetaking activity: factual, conceptual, relational and typical. They predicted that recall would be better for subjects recording notes at deeper levels i.e. more generative processing. Using undergraduate subjects and a 22-minute tape recorded lecture on attention, it was found that despite differential notetaking instructions for factual, conceptual, relational and typical notes, all students took about equal numbers of conceptual notes. There were moderate differences in actual notetaking behaviours but there were no significant main or interactive effects with type of test item for the four treatment conditions. It was also found that the greater the number of words in notes, the better the test performance. Note taking instructions did not radically change individual habits. Kiewra and Fletcher conclude that notetaking directives are not automatically effective.

In conclusion, although the generative hypothesis would seem adequate, results from the few available studies have provided little support for it. It is believed that much necessary information which could illuminate theory and inform the studies is either unavailable or not being appropriately incorporated.

3.9 THE MISSING INFORMATION

Most theories of notetaking -quantitative, qualitative, generative, encoding specificity, levels of processing, are wholly cognitive. Of course notetaking is demonstrably a cognitive activity, but spontaneous notetaking such as occurs in live lecture halls must depend quite heavily on motivational factors. This realization seems lost on researchers. The missing information therefore is about motivation not so much for the lecture but for notetaking itself. Hartley & Davies (1978) have observed that students may produce doodles in the place of notes, write (notes) to keep awake, write because everybody else seemed to be writing, or write to appear conscientious to significant others, notably lec-

turers and experimenters. Nevertheless few notetaking studies have investigated the motivational antecedents of notetaking. This neglect may have resulted from the fact that the great majority of the studies conducted use college students. There appears to be an underlying assumption by researchers that students will take notes because they desire to pass school examinations. Even if this general assumption were justified, can it always be taken for granted in every lecture with all students? It may be profitable to include in studies of notetaking estimates of motivation or compare different types of note takers.

3.10 THE FUTURE OF NOTETAKING RESEARCH

Kiewra (1988) in an extensive review of the research identified the competing theoretical positions as the generative hypothesis and the encoding specificity principle. The specificity principle suggests that the level of processing during notetaking /review specifically facilitates performance on test items which tap that original level of processing, (cf.Tulving & Thomson, 1973). It is argued in effect that there is no one ideal level of processing that accounts for best all round performance, nor can levels be placed on a continuum as this assumes some kind of progression in quantity or quality.

The generative hypothesis on the other hand believes that deeper (i.e. more generative) processing produces more learning in general and also more level related learning and comprehension. Both the generative hypothesis and the specificity principle are useful for understanding notetaking activity, as are the transfer - appropriate processing theory of Morris, Bransford and Franks (1977) and the model of discourse processing offered by Kintsch and Van Dijk (1983).

The generative framework holds promise of producing a model of notetaking which integrates most of the cognitive aspects of notetaking behaviour. The specificity principle should provide pockets of illumination in the total process which will extend explanations of notetaking behaviour and enhance theoriza-

tion in the area. These two paths are complimentary rather than competing. The cumulative product of the two lines of research should provide learning and instructional psychology with a better understanding of the cognitive processing of the learner engaged in notetaking activity or review in natural settings.

To date no model which articulates all the cognitive variables involved in notetaking activity has emerged. It is our belief that investigating notetaking activity within an information processing framework, of which the specificity principle and transfer appropriate hypothesis are restricted examples will provide much needed information regarding the cognitive processes involved.

However, Kiewra (1988) proposes guidelines for further research which could make notetaking research a useful vehicle for studying cognitive operations associated with verbal learning and information processing.

The seven methodological guidelines offered by Kiewra are:

i) Examination of notetaking and review behaviours using qualitative analysis protocols.

ii) Systematic variation of domain-specific knowledge to show its relationship to notetaking /review and achievement.

iii) Inclusion of aspects of information processing abilities.

iv) Varying notetaking and review strategies along a continuum of generativity.

v) Emphasising ecological validity.

vi) Using a variety of criterion measures to assess performance.

vii) Sampling of all educational levels on cognitive aspects of notetaking.

The present research is very much in sympathy with and has tried to reflect these guidelines.

CHAPTER 4

THE PROBLEM

CHAPTER OUTLINE

4.1 INTRODUCTION

In this chapter, it is wished to contextualize the research within a specific framework in modern cognitive psychology. As Gick & Holyoak (1985) observed in general, "it is important to develop a general conceptual framework within which specific issues ... can be formulated." If there is any single and recurrent failing in earlier studies on note taking it is indeed that many have not been situated within a specified theoretical context, and it is only recently that appropriate theory is being constructed around these studies (Kiewra, 1985c). This undesirable situation may not be unconnected with the way research problems have been cast. Howe & Godfrey (1977, p.69) for example, admitted that while it would be fortunate if their own research yielded results of basic or theoretical value, the search for such findings was not to be the major aim of the project.

The present study is of course formulated within the framework of information processing theory. As Anderson (1980) noted, while information processing is not the only theory in modern cognitive psychology it is the most dominant. Information processing originated from work on human factors and information theory which flourished during the second world war. Its development is closely linked with developments in computer science particularly artificial intelligence, and information processing theory borrowed from communication science its characteristic way of analysing the processing of information.

The characteristics of the classical human information processing system are neatly summarized by Simon (1985):

> "Apart from its sensory organs, the system operates almost entirely serially, one process at a time, rather than in parallel fashion. This seriality is reflected in the narrowness of its momentary focus of attention. The elementary processes of the I-P system are executed in tens or hundreds of milliseconds. The inputs and outputs of these processes are held in a small short-term memory with a capacity of only a few (between say four and seven) familiar symbols or chunks. The system has

> access to an essentially unlimited long-term memory, but the time required to store a new chunk in the memory is of the order of seconds or tens of seconds," (p.225).

The assumptions and workings of the classical model are further expanded by Voss et al. (1983). They point out that problem solving activity is assumed to take place in working memory which is considered to have a limited capacity. In terms of problem solving therefore, only a few states of the problem can be held in working memory at any one time. The problem solver is presumed to move from one state to the next without backtracking primarily because of the rapid attrition of information from working memory.

Simon (1985) notes with regard to the current status of information processing theory that,

> "although many of the details of the system are still in doubt, this general picture of the system has emerged from psychological experiments of the past 30 years. Problem solvers exhibit no behavior that requires simultaneous rapid search of disjoint parts of the problem space," (p.255).

This last statement is currently vigorously contested by the group working in the USA on parallel distributed processing (PDP) (Rumelhart & McClelland, 1986). They argue that cognitive tasks seem to require mechanisms in which each aspect of the information in the situation can act on other aspects, simultaneously influencing other aspects and being influenced by them. This general idea of processes that may be parallel, synergic or mutually interactive is carried into the conceptualisation of the present research.

The appeal in PDP models comes from the fact that they seem so much more closely tied to the physiology of the brain, as comprising a large number of highly interconnected elements which send excitatory and inhibitory messages to each other.

The objection of the PDP group to the classical information processing (I-P) model is based on its serial and sequential characterization of human cognition. They point out that attempts to model simple cognitive acts such as recognition of single words would appear to require vast numbers of steps if they are to be sequentially implemented. It is argued that the biological hardware is too sluggish for such models of the microstructure of cognition to provide a plausible characterization of human thinking.

The assumption in PDP models is that I-P takes place through the interaction of a large number of processing units, each sending excitatory and inhibitory signals to other units. In some cases, the 'units' stand for possible hypotheses about such things as the letters in a particular display or the syntactic role of the words in a sentence. In other cases, the units may stand for possible goals and action such as the large-scale goal of typing a specific letter, or the small scale goal of moving the index finger. Connections relate goals to sub goals, sub goals to action and action to muscle movements. In still other cases, units stand for aspects of these things. Thus the identity of a word, for example, is said to be distributed in the activations of a large number of units.

These PDP proposals which arise from an altered view of the time course of processing. are not intended to debunk the whole I-P philosophy, only to offer alternatives to the serial element in the model of the microstructure of cognition. The other components of the I-P model remain unchallenged, including for example, the existence of processing devices or structures, processes and a product. Processing devices are structural entities which must be present in order for processing to be instantiated and sustained. They may be construed as nodes, networks or boxes which are essentially identifiable as knowledge structures and commonly called schemata. Processing devices ensure that cognitive processes can be deployed. What is being suggested is that although schema

theorists and their information processing counterparts may insist on keeping the identities of their respective theories separate, the processing of information would not, in our opinion, be successful without necessary and relevant schemata, as computer simulations of natural language comprehension have shown. Also schema change which Anderson (1977) regarded as a "sine qua non of knowledge acquisition" may be difficult to model or explain without recourse to processes and strategies subsumed in information processing theory.

In the sections which follow, two of the components of the information processing model identified above are briefly examined, namely, processing structures and strategies.

4.2 PROCESSING STRUCTURES (SCHEMATA)

4.2.1 From Lecture To Notes: Language Processing Structures

Lindsay & Norman (1977) aver that the purpose of language is the communication of information between people and involves transmitting the interlocking network of constructs in the speakers' mind to the minds of listeners. They point out that the structures in the mind are complex, intertwined , multidimensional assemblages. But language is conveyed by a relatively slow, linear string of words. Yet somehow the words, spoken one at a time to allow the recipient to construct the proper picture.

Although "straight-through" models exist whereby a student merely writes down everything he or she hears, the more typical case is where (a) the lecturer's words have to engage with existing memory structures in order to take on meaning, (b) the student has also to generate a working or executive schema which makes current sense of the lecture segment, weighs it, and takes decision on whether and how to transform it, and whether and how to write it down.

Reconstructing a mental structure for spoken discourse or exposition is said to rely quite heavily on the listener's prior knowledge. Spiro (1980) noted that "meaning does not reside in words, sentences, paragraphs, or even entire passages considered in isolation...". He suggests that what language provides is a skeleton or blueprint for the creation of meaning. Constructing meaning ensures language comprehension and this is accomplished through the embellishment and enrichment of the skeletal representations which conform with the listener's world view. In this context, world view is synonymous with prior knowledge which is organized in holistic structures called schemata.

Schemata are sometimes referred to as frames, scripts, plans, or memory organizing packets (MOPs). The notion of schema finds its way into contemporary cognitive psychology from the writings of Bartlett (1932), and Piaget (1958), though mainstream experimental psychologists have sometimes exercised resistance to the idea because of its early history of vagueness. More recently however, the basic ideas have been extensively developed, (Rumelhart & Ortony, 1977; Rumelhart & Norman, 1978; Bobrow & Norman, 1975; Minsky, 1975; Schank & Abelson, 1977; Rumelhart, 1981; Rumelhart & Norman, 1985).

Rumelhart & Norman (1978) describe schemata as models of the outside world which represent all levels of our experience at all levels of abstraction. Rumelhart & Norman identify the following as important characteristics of schema:

1. "Schemas have variables;
2. Schemas can embed, one within another;
3. Schemas represent knowledge at all levels of abstraction;
4. Schemas represent knowledge rather than definition;
5. Schemas are active recognition devices whose processing is aimed at the evalua tion of their goodness of fit to the data being processed", (p.36).

The effects of schema are said to be observable in the difference prior knowledge confers on constructed meaning. This constructive view of language comprehension was highlighted by Bartlett (1932) and emphasizes the importance of what is already known in determining what will become known (Winograd, 1977).

Nelson (1977) also observed that the construction of meaning based on relation of prior knowledge with the novel event is basic, arguing that it is necessary to recognize that the cognitive system is functional, predictive and above all based on prior knowledge.

Moving from this fairly important yet deterministic and static position concerning the influence of schemata, Mayer (1977) provided information concerning the progressive increment due to prior knowledge. A process of "assimilation to schema" is proposed. This is described as the acquisition of new material in the learner by assimilating it to some aspect of existing cognitive structure or schema. This produces a new and reorganized cognitive structure which integrates old and new knowledge and in turn may serve as an assimilative schema for subsequent learning, (see also Schallert, 1982).

Ausubel (1960, 1962, 1978), brought the notion of schema to general attention through the concept of advance organizers, (Ausubel & Youssef, 1963; Ausubel et al., 1968). He believed strongly that an individual's cognitive structure in a particular subject matter is the most crucial factor in the meaningful learning and retention of new material. This is illustrated in a study by Anderson et al. (1977) in which they showed that students brought their specific curricular knowledge to bear differently in the comprehension of a passage that could be interpreted in more than one way. Feuerstein et al. (1979) have developed a popular programme called Instrumental Enrichment directed at teaching intelligence to adolescents based largely on the training of prerequisite cognitive schemata emphasizing the importance of availability of relevant schemata, although Barnes & Clawson (1973, 1975), in a review of research on organizers concluded that the evidence is equivocal as to whether organizers do make a difference.

The point being made so far is that schemata appear important for understanding of verbally transmitted information. For understanding to be attained, processing of the to be learned material in close conjunction with already known material is vital. The kind of cognitive processing deployed in cognitive performance has further been shown to depend on the individual's knowledge base (Chi, 1978; Daneman & Carpenter, 1983; Perfetti & Lesgold, 1977). But to understand the nature of this relationship fully, it is necessary to examine both cognitive processes and the notion of processing strategy.

4.3 COGNITIVE PROCESSES AND COGNITIVE STRATEGY

There now exists a considerable body of knowledge that describes and explains processes and strategies in a context of human problem solving (Simon, 1985). Though the literature is not terribly clear on the distinction between processes and strategies, we assume that a combination of processes operating together to reach a solution, a goal, can be regarded as strategy.

Studies of learning which come under the levels-of-processing approach are here regarded as concerning processing strategy. As first proposed by Craik & Lockhart (1972) in relation to verbal information processing, the concept of levels of processing assumes that information is processed along a continuum of "depth". "Shallow" processing occurs at the lower end and is characterized by attention to the physical elements in the message. "Deep" processing, at the other end of the continuum, is presumed to leave more enduring traces in memory due to the attention paid to semantic associations. Laurillard (1979) identified occasions when deep processing can be inferred, as when attention is focused on the content as a whole, attempts are made to see the connections between different parts in the material, or thought is given to logical connections, or the structure as a whole is considered. By contrast, surface or shallow level processing refers to those occasions when focus is only on elements of the content, the task is seen primarily as a memory task, or the task is approached unthinkingly.

Extensive research has been conducted in several countries and it lends support for the levels of processing construct (Entwistle & Wilson, 1970; Entwistle et al., 1979; Marton & Saljo, 1976; Biggs, 1976, 1979; Fransson, 1977; Schmeck & Phillips, 1982). This line of thinking and research has been useful in illuminating how students learn through engaging in processes that qualify as deep or shallow on the strategy scale. Strategy adoption can itself be influenced by factors such as task requirements and problem solver's intentions or goals, as Ramsden (1979), Saljo (1979), and Laurillard (1977) show. An underlying assumption in the levels of processing approach is that different kinds of understanding can be achieved on the basis of the level of processing adopted.

4.4 The Information Processing Model Applied To Note Taking

A useful point to begin this exploration might seem to be with an examination of the processes and structures indicated by earlier research as involved in notetaking activity. However, the early studies on notetaking are not very useful in the identification either of the important cognitive structures or of the key processes in notetaking. Most of this early research on notetaking was conducted within a theoretical framework akin to the connectionist approach. That is to say, there was a concentration on the outcome or product of processing, itself a reflection of the "black-box" tradition at the time when research energies were expended largely on the input-outcome dimensions. "Taking of notes" was the usual input and "amount of recall" the outcome. It is therefore difficult and perhaps unnecessary to expect from such studies any explanations consistent with an I-P perspective.

The influence of information processing theory is evident in more recent notetaking studies (Kiewra & Fletcher, 1984; Jonassen, 1984; Bretzing & Kulhavy, 1979; Shimmerlick & Nolan, 1976; Abbott & Hughes, 1984; Barnett et al., 1981). In some of these studies, (Kiewra & Fletcher,1984; Jonassen, 1984)

knowledge from learning strategy research has been deployed to direct subjects' notetaking activity within an I-P context, though with little success. Other studies have investigated such aspects as individual differences in working memory (Berliner, 1969; Di Vesta & Gray, 1973), and findings here indicate that capacity limitations determine the extent of notetaking. What could be more useful might be to link efficiency of working memory, or some other index of I-P ability, with differences in note taking. One recent study, Kiewra & Benton (1988) does this and the results suggest that information processing ability is a significant predictor of words recorded in notes.

Cognitive processing microstructure has received but limited attention in the notetaking literature, (Peper & Mayer, 1978). It is clear that the task of detailing cognitive structures and explaining the cognitive processes in the activity is still in its infancy. Information of this kind will surely make the building of a theory of notetaking easier. An I-P model of notetaking is attractive because it could provide information on the following;

1. The cognitive structures which modulate the activity.

2. The cognitive processes involved and their manner of instantiation and interaction.

3. The relationship between these structures, processes and measureable performance outcomes.

4.5 STATEMENT OF THE PROBLEM

As a classroom teacher, the present researcher has been impressed by students' heavy reliance on notes. Accordingly, the specific questions for which answers were sought were as follows:

1. What are the constituent cognitive processes for note taking, i.e. how is lecture material processed for note taking and are "levels of processing" discernible?

2. How is cognitive processing reflected in notes?

3. Is comprehension itself reflected in notes?

4. Will the influence of prior knowledge be evident in the noting and comprehension of ideas transmitted in a lecture?

5. Do age and gender of subjects relate to their noting and comprehension of lecture material?

6. Can intervention be planned to improve notetaking skills?

4.6 OPERATIONALISATION OF VARIABLES

In typical psychological experiments, a subject is presented with a "stimulus" and a "response", its correctness and the time it takes to make it become the principal data for analysis. Such input-output measurements have been described as an unpromising way of learning about the intervening processes (Simon, 1985). Yet these intervening processes are of course central in the I-P model. Consequently techniques for increasing the number, kind and loci of observations in the stream of information processing activity in a problem situation have received increased attention. Examples of such data are verbal protocols or talk-aloud techniques.

In the present studies, students' written notes provided one means of observing and interpreting their processing activities. The notetaking processes inventory was another route via which students' processing activity could be accessed. All the activity which occurred following the presentation of the stimulus right up to the production of notes was defined as processing activity; students' notes are then regarded as the intermediate processing product and overall comprehension as the final product.

CHAPTER 5

STUDY 1

IMPROVING LECTURE COMPREHENSION AS TRAINING FOR NOTETAKING

CHAPTER OUTLINE

5.1 INTRODUCTION

The reader might be forgiven for wondering how this first study can take on training issues when the cognitive processing elements in the lecture - comprehension sequence have not yet been elucidated. The reason is historical, in the sense that the study represents an entry point into the problem field. The objective was consciousness-raising of conceptual issues for later studies rather than any wish to pre-empt those issues. In the event, the achievements of the study were very modest for theory but very important for the classroom-teacher-researcher from the standpoint of induction into the research area. It is on this latter basis that the study is reported here.

There have been very few studies devoted to the training of notetaking skills even though taking notes is a crucial activity for most students. The desire to find out how notetaking can be improved thus motivated this first study. It was conceived as a training study in which an attempt was made to teach students strategies for improving comprehension via improved representation of lecture material in their notes.

Kiewra (1985b) expressed the belief that student notetaking is often brief and of questionable value. The available evidence suggests that although students' notes may indeed be brief, their value for the note taker at least is far from questionable. It is therefore reasonable to argue that researchers should be concerned with attempting to improve student notetaking in order that the personal value of notes be increased.

One source of influence on the present study comes from the dearth of ecological validity in research on notetaking. The major researchers on notetaking (Hartley, 1978; Howe, 1975; Kiewra, 1975), have remarked on the preference among researchers for laboratory studies and point out that naturalistic studies are necessary for better understanding of the activity. But there have been few naturalistic studies of notetaking and fewer still of notetaking training in natural contexts.

Five studies were located which involved training strategies (Corey, 1935a; Palmatier, 1968; Bizinkaukas, 1970; Palmatier & McNinch, 1972; Driskell, 1976). Four of these studies reported no significant differences between the trained and untrained groups. In all these studies, however, either the method section or concluding remarks indicated that the training period was short, usually less than four weeks. Only in one study was there a significant difference in favour of the trained group. This study (Driskell, 1976), lasted longer than any of the others, in fact for six weeks. Driskell's sample consisted of low ability college freshmen, described as "borderline", who perceived the training as relevant. This study was perhaps successful because it was more than just training in notetaking skills - a comprehensive study skills programme was involved. This was at the same time a strength and a problem for the study: the increased grade point average which was the dependent measure in the study could not be interpreted as wholly due to increased notetaking skills because of the very real possibility of confounding with improvement in study skills generally.

Other studies which may not have suffered from confounding skills training, may nevertheless have used ineffective instructions. The study by Corey (1935a), like those of Jonassen (1984) and Kiewra & Fletcher (1984) cannot truly be labelled training studies because notetaking "strategy" was directed rather than taught. Perhaps the finding of no significant difference is not unexpected given Kiewra & Fletcher's observation that directives and instructions were even then not automatically effective.

In addition to these kinds of flaws, some of the training studies have failed to identify clearly the specific notetaking strategy that was being trained. Palmatier (1968) for instance, gave the different groups in his study a series of directives some of which seemed but tenuously linked with notetaking skills or strategies. The Palmatier study also involved practice not only in notetaking, but in revision and study. More recent studies are better in identifying the strategy as such but these are also short on training or practice sessions (cf.Jonassen, 1984; Kiewra & Fletcher, 1984).

Whereas training studies on notetaking are few and confounding of various skills and strategies common, virtually all books and manuals on "how to study" seem to give a plethora of specific advice on how to take good lecture notes. Yet as Ganske (1981) argues, when research evidence is sought to justify these recommended procedures it is found lacking.

Current learning strategy research is useful in providing a pool of strategies on which notetaking researchers can draw for use in training studies. Two strategies recommended in how to study manuals which have enjoyed research attention are summarizing and networking/elaboration. These two particular strategies were selected for use in the present study for this and for three other reasons.

First, summarizing and networking have been extensively researched (Brown, Campione & Day, 1981; Brown & Day, 1983; Brown, Day & Jones, 1983; Brown & Palincsar, 1982; Brown & Smiley, 1978; Brown, Bransford, Ferrara & Campione, 1983; Trabasso, Secco & Broek, 1984; Mayer, 1984; Weinstein, 1978; O'Neil, 1978; Dansereau, 1978; Rohwer, 1973). Secondly, and more important, these strategies have been demonstrated to improve comprehension. For example, Brown, Campione and Day (1981) state categorically that the "ability to provide an adequate summary is a useful tool for understanding texts." They aver that the ability to summarize material that one has been reading or learning is a common and a sophisticated method of testing one's comprehension of the material. They observe, though, that efficient summarizing is a difficult task for "immature" learners.

Summarizing and networking were also chosen because they are recommended by Mayer (1984) to be more effective where there is a minimum of background knowledge available, a condition that could be assumed with the Study 1 sample who had never studied the psychology of education.

The nature of the relationship between summarization and comprehension is clarified by Winograd (1984) who believes that both summarization and comprehension require the reader to reconstruct an internal representation of the

message. Constructing hierarchies of knowledge in which successive subordinate strata effect a coherent elaboration of the message also enhances internal representation. Strategies for subordination and hierarchization, sometimes referred to as elaboration or networking have been shown to be one of the hallmarks of expert performance in comprehension tasks (Bereiter & Scardamalia, 1984; Ballsteadt & Mandl, 1984; Schnotz, 1984; Voss, 1984).

Many models of reading comprehension describe reading as a process of writing new information to representations already in place or of forming new connections between established knowledge elements (see Chapter 4 discussion on schemata). The linking process can also be local and immediate as in the case of propositions in a text which appear successively. Networking thus represents local "coherence building", a strategy commonly recommended in how-to-study manuals and sometimes referred to as patterned notetaking or spider outlines (Buzan, 1974; Parsons, 1976; Acres, 1987).
The aim of the present study was thus to train students in the use of summarization and networking strategies to improve their comprehension of lecture material and eventually, notetaking and performance. Three hypotheses were advanced:

1. Summary students would score higher than controls in a post test.

2. Network students would perform better than the controls in a post test.

3. The performance of the groups would be different, and in the direction of networking > summarizing > control.

5.2 METHODOLOGY

5.2.1 The College Setting

The study was conducted with students at a technical teacher training college in Lagos, Nigeria. The college offers training which leads to the award of two kinds of certificates; the National Certificate of Education, (NCE), and the Technical Teachers Certificate, (TTC). Training for the NCE lasts a minimum of three years and students with three to five passes in the relevant subjects at the G.C.E. ordinary level can be admitted onto the course. The technical teachers certificate course lasts for one year and it is offered to candidates who possess technical and commercial qualification along with appropriate work experience and who wish to become classroom teacher.

The subject, Psychological Foundations of Education (sometimes called Educational Psychology) is taken in the second year. The students also take other educational and technical subjects, these being referred to as special or area subjects. There are five special areas (subjects) which roughly form the departments in the college. These include accounting, secretarial studies, building, mechanical and electrical studies. The Department of Education offers courses in pedagogy which include the following; philosophical foundations of education, sociological foundations of education, educational administration, comparative education, principles and methods of teaching, guidance and counselling, testing and measurement and psychological foundations of education. Recently in 1987, a new course was introduced in the Department of Education entitled Management in education which is a mixture of sociology, psychology and educational administration.

Students need to pass both the education subjects as well as the special courses (subjects) to be awarded a certificate which qualifies them to teach their special technical or commercial subjects in secondary schools.

5.2.2 Subjects

Eighty-eight students between the ages of 19 and 32 years in two of the five second-year groups participated in the study. The sample comprised fourteen females and seventy-four males, which is representative of the proportion of the sexes in the technical departments. There were twenty-six students in the summarizing group, twenty-five in the networking group and thirty-seven in the control group.

5.2.3 Materials

Normal lecture material was used for the training exercises. The lecture material was culled from the actual outline for the course prepared by a national curriculum body - the National Board for Technical Education. A course outline of Psychological Foundations of Education for the term during which training was administered can be seen in Appendix 5.2(a), and that for the whole year in Appendix 5.2(b). All the lectures were equivalent in length and difficulty. The first lecture which also formed the material for the first training session was videotaped. There were no interruptions from students as is common in a live lecture. The lectures as a whole covered the following topics: history and branches of psychology, relevance of educational psychology, general principles of growth and development, stages of human growth and development, heredity and environment. A full text of the first lecture is provided in Appendix 5.1.

Other kinds of information gathered from each participant included the following:

(i) general ability score,
(ii) measure of language ability,
(iii) score for mathematical ability,
(iv) a score on an end-of-term achievement test, and

(v) scores on a post-training evaluation questionnaire.
Scores for i, ii & iii were computed from the student's academic record which qualified him/her to be admitted into the college. These were usually G.C.E. 'O' levels or City and Guilds examinations. The scores were given by the students in a questionnaire and were corroborated from college records. The general ability score (GA) was the average of each individual's performance in all the subjects taken at specified examinations.

A sample of students' notes for the whole term was collected at the end of the term for analysis.

5.2.3.1 Course Evaluation Questionnaire

The course evaluation questionnaire consisted of fourteen items and served as an instrument for evaluating both the course as a whole and the perceived effectiveness of the training administered. Three of the items related directly to the training. Four of the items were biographic, eliciting information on the respondent's name, class, gender, and age. There were three items concerned with assessing how much the students had learnt/understood of the course. Three other items sought information about the pattern in abilities that was perceived by the students as helpful in their understanding of the subject matter. The final three items were related to students' notetaking behaviour, the changes and reasons for them. The questionnaire is shown in Appendix 5.3.

5.2.3.2 End-of-term Test

An achievement test comprising four essay questions covering the entire subject matter of the lectures was administered in the seventh week of the 8-week term. Subjects were instructed to answer any two of the four questions. The

test which included recall and comprehension items lasted one hour. The test and the marking scheme used were validated by three other members of the Department, two of whom taught Psychological Foundations of Education, while the other was the head of the department of Education. This validation of questions and marking scheme was straightforward since it followed standard practice in the college, usually involving all members of the Department content-analysing the material. A sample of the test scripts was also marked by the researcher and two of the teachers who had taught the course in the past. The percentage agreement was high (97%). The test questions appear in Appendix 5.4.

5.2.3.3 Student Notes

Students' notebooks were examined for the following;
i) presence/absence of notes,
ii) source of notes, and,
iii) strategy use in notes.

Presence of Notes

Although information of this kind may seem peripheral to the central concern of this study, it was thought necessary to ascertain the extent of note-having among these particular students.

Source of Notes

The training administered was for the taking of notes from lectures as opposed to notetaking from written texts, text books, or other sources and it was therefore important that the notes being examined had been taken within the specified context i.e. from lectures or alternatively in the training sessions.

Strategy Use in Notes

Examination of the noting pattern of the strategy being trained was useful in attempting to understand how students had perceived the training given. Notetaking research indicates that students usually record important points. Further, did students in the present study consider the training important enough to keep a record of it in their notebooks? It was also reasoned that the presence of strategies in notes recorded at lectures would present some evidence of training effectiveness.

5.2.4 Procedure

At the beginning of the term (and school year), the treatment groups were informed by the researcher that they were going to be taught how either to summarize lecture material or to produce network diagrams. Six training sessions (T1 - T6), were held over six weeks, each session lasting one hour. Training sessions were held two days after each lecture, the material used for training being that which had been delivered two days previously. Students attended one lecture and training session each week.

In the first training session, (T1), students were informed about the experiment. They were made aware of the aims of the study, the benefits that would accrue from it and also what they were expected to do during the practice session (as advocated by Brown & Day, 1981).

The last training session (T6), was devoted to evaluating the course for the term together with the training received. Students completed the fourteen-item Course Evaluation Questionnaire. At the end of the term, the achievement test was administered to all the students.

The next section describes in detail how training was conducted.

5.2.4.1 Training: Modus Operandi

During the training which was directed by the researcher, students in the summarizing group each made a summary of the specific lecture after having been taught how to make summaries by first identifying and then stringing together the main ideas. Similar summaries were grouped together. One "best" representative of each summary group was written on the chalkboard. There were usually between three and five group summaries. These were then evaluated by the students under direction from the researcher with such questions as "Is that a main idea? What main idea is missing from this summary? Does this summary represent all the information contained in Monday's lecture?" At the end of this exercise, a final summary was produced, usually by the students themselves. An adequately worded version of the final summary was then written on the board.

An example of a summary produced for the first lecture (L1) is; **"the history of psychology can be traced to philosophy and physiology. The subject is divided into many areas today including for example social psychology, clinical psychology and psychometrics."**

Students in the networking group were involved in essentially the same kind of interaction as those who did summaries. The difference was that, instead of summaries, this group was taught to draw networks by linking the main ideas in the material using vertical and horizontal lines. These individual networks were evaluated in the same manner as the summaries. As with the summary group, identification of the main ideas was carried out first. Questions like, "Are these ideas equally important? Which of these ideas should come under this one? How are these ideas related?" were used by the researcher to impress the relational nature of lecture points. The network diagram produced for the same lecture (L1) can be seen in Appendix 5.5.

5.3 RESULTS:

5.3.1 Pre-treatment Equivalence of Groups

The means and standard deviations of scores for the three groups on the independent variables used in the study are shown in Table 5.1.

Table 5.1

Group means on ability measures and test scores

	GA		LA		MA		TS	
Group	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	S	$\bar{X}$	SD
S (26)	3.8	2.5	2.5	1.9	3.1	2.4	20.5	3.8
N (25)	3.6	1.8	2.6	1.7	4.1	2.5	19.8	3.5
C (37)	4.4	1.0	3.3	1.5	3.8	2.0	19.4	3.3
A (88)	3.9	1.8	2.7	1.7	3.6	2.0	19.7	3.4

A = All subjects
S = Summary
N = Network
C = Control

GA = General ability
LA = Language ability
MA = Mathematical ability
TS = Test score (out of 40)

T-tests revealed that the group means were not significantly different on the general and mathematical ability measures. Scores for language ability indicate that the control group mean was significantly higher, (3.3), than the mean of the summary group (2.5). The difference in language ability between the networking and summary groups was not significant, (means = 2.5 and 2.6). Thus

on two of the classifying variables used in the present study, GA and MA, all three groups were equivalent, but not on the third, language ability.

5.3.2 Post-treatment Analysis

A one way analysis of variance was performed on test scores between summary, networking and control groups. Table 5.2 shows the analysis in summary.

Table 5.2

ANOVA Test Score X Group X GA X LA X MA

Source of variation			Sum of squares	DF	mean square	F	Significance
Main effects			194.539	5	38.908	3.537	0.007
GP			33.707	2	16.854	1.532	0.224
G			8.707	1	8.707	0.791	0.377
L			32.540	1	32.540	2.958	0.090
M			104.767	1	104.767	9.523	0.003
2-Way Interactions			51.852	9	5.761	0.524	0.852
GP	G		11.316	2	5.658	0.514	0.600
GP	L		9.931	2	4.965	0.451	0.639
GP	M		24.916	2	12.458	1.132	0.329
G	L		0.061	1	0.061	0.006	0.941
G	M		5.600	1	5.600	0.509	0.478
L	M		8.641	1	8.641	0.785	0.379
3-Way Interactions			59.643	7	8.520	0.774	0.611
GP	G	L	20.896	2	10.448	0.950	0.392
GP	G	M	30.542	2	15.271	1.388	0.257
G	L	M	1.691	2	0.846	0.077	0.926
G	L	M	1.984	1	1.984	0.180	0.673
4-Way Interactions			40.201	2	20.101	1.827	0.169
GP	G	L	40.201	2	20.101	1.827	0.169
Explained			346.235	23	15.054	1.368	0.163
Residual			704.084	64	11.001		
Total			1050.318	87	12.073		

GP = Group (Summary, Network, Control) G = General ability
L = Language ability M = Mathematical ability

The results indicate that the experimental treatments (group) did not exercise a significant effect on achievement test scores. The mean scores obtained were; Summary = 20.5, Networking = 19.8, Control = 19.4. The scores show that though slight differences existed they were not significant and not in the hypothesized direction. The analysis of variance yielded a significant main effect only for mathematical ability, F (1,87) = 9.5, p = .003. No interactions were significant as Table 5.2 reveals.

5.3.3 Questionnaire Data

Participants' perception of effectiveness of training administered was tested by the application of a chi square test on the questionnaire responses. Results in respect of three questionnaire items are now reported.

5.3.3.1 "Has your notetaking changed?"

The figures in Table 5.3 are in respect of the questionnaire item which asked students whether they considered their note taking had changed. The pattern of responses from the three groups are significantly different (chi square = 6.87, df = 2, p = .03)

Table 5.3 Change in notetaking

Has your notetaking changed?

Group	No	Yes	Total	%
Summary	3	22	25	30.1
Networking	10	14	24	28.9
Control	14	20	34	41.0
Total(%)	27(32.5)	56(67.5)	83	

chi square = 6.87 df 2, p = 0.03

Two thirds of the total sample (67.5%) indicated that their notetaking had changed. The percentage of changed and unchanged note takers in both the networking and control groups was very similar. In the networking group, 42% of the students indicated that their notetaking had not changed, and 58% considered it had. The corresponding figures for the control group were 41% and 59% respectively. In the summary group, 88% of the students believed that their notetaking had changed in the period.

It is fairly clear from Table 5.3 that the summary group has much the largest difference between the "change" and "no change" groups.

Three chi square tests involving group pairs (summary versus networking (S vs N), summary versus control (S vs C), networking versus control (N vs C)), revealed that only the summary group was different from the no-training control. The networking and control groups were equivalent. The values obtained for corrected chi square computations were as follows; chi square S, N = 3.14; S, C = 4.64; N, C = 0.05 (p = .05).

5.3.3.2 "Is the change worse or better?"

Fifty-six students who had indicated that their note taking had changed were asked to describe the change as either better, worse or same, the difference between the groups was only marginally significant (chi square = 5.24, df = 2, p = .07) as the figures in Table 5.4 suggest.

Table 5.4

Quality of change in notetaking skill

	Note Quality		
Group	Same	Better	Total %
Summary	4	11	15 26.8
Networking	12	7	19 33.9
Control	13	9	22 39.3
Total	29	27	56
%	51.8	48.2	100.0

chi square = 5.24 df = 2, p = 0.07

No participant indicated that his notetaking had deteriorated in the period. Although 41% of the students in the summary group had considered that their notetaking had become better, only 26% and 33% of those in the networking and control groups respectively shared this view. This result suggests that the notetaking behaviour of students in the networking group had changed the least. The response patterns of the networking and control groups were very similar.

5 . 3 . 3 . 3 "Why has your notetaking changed?"

When the reason for the change in notetaking is examined, the similarity in the response patterns of the networking and control groups disappears. Asked about the possible sources or reasons for changes in their notetaking skill, the response patterns for the three groups were significantly different (chi square = 12.95, df 6, p = .04) as the figures in Table 5.5 suggest.

Four sources of change were identified; teaching style, familiarity, training and personal factors labelled as "other" in Table 5.5.

Teaching style represented such aspects as were peculiar to the teaching of the subject. Students were commonly given notes by lecturers in the college. But the researcher in the present study neither gave notes (dictated notes or hand outs) nor were lecture notes handed over to students to copy. Any reason that was related to this was therefore coded as teaching style.

Personal factors included reasons which indicated personal growth or development such as "I have learnt", "I now know how" etc. When students' reasons indicated that their notetaking had changed because they now know the subject better, and similar remarks, familiarity was the coded reason for change. etc. It was fairly obvious when training was the source of change from responses such as "I learnt during the seminar".

Table 5.5

Reasons for change in notetaking

	Reason				
Group	Other	Familiarity	Teaching	Training	Total
Summary	9	1	3	9	22 41.5
Networking	3	3	4	3	13 24.5
Control	8	4	6	0	18 34.0
Total	20	8	13	12	53
%	37.7	51.1	24.5	22.6	100.0

chi square = 12.95 df 6, p = 0.04

Nearly equal numbers of subjects in the networking group offered reasons that span all the categories of responses, 31% of these students considered that the reason for their changed notetaking was teaching style and 69.3% indicated that the other three factors (personal, familiarity with subject and training), shared equal responsibility for the change.

Among the control group responses showed that the most prominent reason for change was personal factors. Equal numbers of students in the summary group considered training and personal factors as responsible for the change. This last result is interesting but difficult to interpret. Had the training had been effective to a point where the students had integrated the change so successfully that they attributed it to their personal development? Or had they simply perceived the training as ineffective and the change due to their own personal effort? It is difficult to say but given the pattern of results the second seems the more

likely.

Examples of reasons for claimed changes in notetaking skill are given in Table 5.6.

TABLE 5.6 EXAMPLES OF REASONS FOR CHANGE IN NOTE TAKING

Group	Other (Personal)	Familiar	Teaching Style	Training
Summary	'My note taking has changed because of want to improve in order to make me understand better and will enable me to improve better.'	'I can here say that my taking of notes is changed as at present I become more conversant with the knowledge and concepts of the subject matter .'	'Because when it has been crosschecked by the lecturer I then become sure that it has improved'	'Because I don't use to summarize my note but now I do¦
Networking	'It has changed because of the interest I developed during the course of duration.'	'Because my understanding of psychology has improved from good to better conditions.'	'I dont normally write fast before but due to my educational psychology lectures I was able to improve the speed of my writing and thinking fastly.'	'Because before I need to take down every word the lecturer says but now it has improved by taking down important points during lecture period.'
Control	'I would be patient while the lecturer is giving lecture and jot down in a piece of paper then later for my own note.'	'My note taking has changed because psychology is new course to me and I find it difficult at first	'Because I need to form note on my own after the lecture.'	

Table 5.6: Cont'd

Group	Other (Personal)	Familiar	Teaching Style	Training
Control	———	to write note, but later I become familiar with the subject and my note taking has improved later.'	———	———

5.3.4 Analysis of Notes

Another kind of evidence for the lack of effectiveness of training was provided by content analyses of students' notes. A sample (15) of students' note books was examined. Seven of the notebooks belonged to students in the summary group and eight were from the networking. No notebooks from the control group were examined.

Data in respect of notes taken at six lectures covering the topics identified in the course outline are presented first. It will be recalled that the lectures were independent of training sessions. Table 5.7 shows the number of students who had notes, those recorded from lectures and the extent of strategy use within notebooks. As stated earlier, the reason for looking at notes taken at lectures which seemed to have nothing to do with the training administered was to discover if there was any evidence of strategy use in notebooks. For this analysis, it was sufficient just to observe the presence or absence of a) notes, and b) strategy within notes for the students as a whole.

Table 5.7

Content of student lecture notebooks

Lectures	L1			L2			L3			L4			L5			L6		
	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O
Notes	12	1	2	14	1	0	15	0	0	14	0	1	15	0	0	14	0	1
Source	10	2	3	11	2	2	11	4	0	13	1	1	14	1	0	11	3	1
S'n use	2	9	4	0	13	2	0	14	1	0	14	1	0	15	0	0	14	1

Notes Y = yes N = No O = Missing/absent
Source Y = Lectures N = other O = Missing /absent
S'n use = Strategy in use in notes.

The figures in the table above indicate that students generally always produce notes, a fact hardly in dispute. A large proportion of the students' notes, also not surprisingly, were made at live lectures, (10, 11, 11, 13, 14, 11). The results also show that in five of the six lectures, none of the students' notes represented either of the trained strategies. Two out of the fifteen lecture notes contained network diagrams in the first lecture. This suggests that very little transfer of strategy use occurred across situations from training to lectures. But perhaps searching for the evidence of strategy use in lecture notes is not altogether legitimate because the lectures were conducted with complete independence from the training sessions, their only link being in the use of the material delivered at previous lectures for training.

Data from the training sessions is dissimilar to that from lectures with regard to the noting of strategies. Four out of the 15 students equally recorded either summaries or networks in T1, and the numbers for T2 - T4 were as follows; T2 = 10, (summary = 7, network = 3); T3 = 2, (summary = 1, network = 1); T4 = 11, (summary = 7, network = 4). The scores reflect some kind of a pattern. In the first and third training sessions (T1, T3), about 20% of all the notes contained the trained strategy while in the second and fourth sessions (T2, T4), more than 66% of the notes contained network diagrams, summaries or both. The results indicate clearly that more summaries were recorded in notes taken at training sessions.

It was observed that in either training group (summary or networking), notes contained the strategy the other group was being trained to use. Thus, in T1, one note contained both strategies, in T2 there were five such notes and in T4 the number had risen to seven. Students copied each others notes, it appears, increasingly as the term progressed.

These results are not particularly easy to interprete especially as training session, T2 and T4 were more than twice as heavily recorded as T1 and T3. It is plausible that in the first training session, the students were unsure about the status of the network or summary and consequently did not record it.

If this were the case in T1, how can we explain its recurrence in T3? There is reason to believe that the subject matter/content of T3 which seemed very similar to the material covered in T1 and T2 made the students think they already had a record of it in their notes.

5.4 DISCUSSION

The present study was an attempt to train students in the use of two strategies hypothesized to improve the comprehension of lecture material. As accepted at the outset, the study produced few substantial findings and is best seen as a pilot for the major studies to follow.

It was hypothesized that students trained in the use of summary or network production would perform better than students who received no training. The data presented do not support the hypotheses. The differences in scores between the groups did not reach statistical significance, and they were not in the hypothesized direction (N > S > C). Though statistically nonsignificant, the summary group performed best of the three groups.

The finding of no significant differences between the trained and untrained groups is similar to those of Corey (1935), Palmatier (1968), Bizinkaukas (1970), and Palmatier & McNinch (1972). This type of result is quite common as Brown, Palincsar and Armbruster (1984) point out. Brown et al.(1984) opine that for cognitive training studies to be successful, they need to be comprehensive including, not just a single activity, but a package of skills. As noted earlier, the penalty of this for interpretation is that the contribution of each component to outcome can be hard or impossible to discern. However, Brown, Palincsar and Armbruster (1984) showed that although the combined package of paraphrasing, questioning, predicting and classifying was the most effective intervention, summarizing was the most powerful component of the package.
It is suspected that the superiority of the control group in language ability may have contributed to the lack of a significant finding because language ability

cannot be divorced from language (lecture) comprehension. What is being suggested is that the initial superiority in language ability in the controls, played a compensatory role for their lack of training. The absence of a significant difference between the two trained groups can be explained by the ineffectiveness of experimental controls. It was observed that some students in both groups copied each others notes, a behaviour perfectly understandable and acceptable from the student perspective, but not from the researcher's. It was also felt that the students were uncomfortable and unaccustomed to two subgroups of the same class being treated differently.

The finding that mathematical ability accounted for a significant percent of test performance can be explained by the fact that the students in the study were in the technical departments where mathematics ability ought ot be a significant variable in course performance. We also believe that as in the Palmatier (1968) study, training may not have continued long enough to result in significant gains in either experimental group.

The questionnaire results indicate that the summary group believed most strongly that their notetaking skills had improved. The largest single reason for change in notetaking skill attributed to training was also made by this group. The network group did not perceive that training had caused any change in their notetaking skill. The training which involved identifying the main ideas in the lecture material along with the spatial linking of these in a subordinate-superordinate manner may have been a difficult task for students with little background knowledge in the subject matter. Kiewra & Fletcher (1984) similarly found that students in their sample found it difficult to record relational notes even after directives to do so. This would seem to explain the similarity in response patterns between the network and control groups with respect to notetaking skill.

To sum up therefore, the hypothesis that both summary and networking groups would out perform the control group was not supported. Similarly, the hypothesis which stated that students who had received networking training would score higher was rejected. Although the summary group with the most improved notetaking skill also had the highest mean score on the test, this was not statistically significant.

These results underscore the methodological arduousness in conducting research of a naturalistic kind and point out the flaws in the present study. The observation that students noted not just the strategy being trained in their specific groups but also that of the other group highlights the difficulty in keeping groups intact and truly different, especially as in this case, when both groups came together as one at other times and had to take the same test, common features of course in live classrooms.

In conclusion, it can be stated that training may improve notetaking. Summary training improved not just notetaking but test scores (albeit not significantly). The implication for notetaking research is that notetaking is related to performance through comprehension and if comprehension of the material to-be-noted can be increased, test performance may also be improved. But the search for the effective strategies with which to accomplish this ought to commence.

In our opinion, this search could begin with examination of the strategic processes students engage in notetaking in live classrooms and lectures. This would make the relationship between notetaking behaviour and comprehension better understood. Information of this kind could then become useful in teaching a strategy for taking notes.

CHAPTER 6

STUDY 2: NOTETAKING PROCESSES WITHIN THE LECTURE

CHAPTER OUTLINE

They do not summarise.
They do not draw networks.
Pray, what do they do?

6.1 INTRODUCTION

The prefacing statement above effectively captures the essence of the present study, in which the the actual processes deployed in the activity of notetaking are investigated. The study is situated within an information processing framework in which deployment of processes in the execution of cognitive tasks is a fundamental notion. Information processing theorists have made real progress in uncovering processes in the solution of relatively well-structured problems of the type common in psychological laboratory experiments. However, a large number of problems and phenomena encountered in real life are ill-structured and investigations into the processes operating in problems of this type are few. Notetaking activity which can be placed somewhere in the middle ground with respect to problem structure is typical in suffering from a dearth of investigations into the processes involved.

Research on notetaking is fashionably and rather loosely classified as that of "process or product". The process tag is something of a misnomer which is typically used to represent a great variety of processes within the global construct of encoding. What it is self-evident is that process studies ought to be concerned with examining the operations and strategies adopted in notetaking. This has been given little research attention. Although the cognitive processes which accompany notetaking have remained largely uninvestigated, there is a consensus among notetaking researchers that encoding accompanies notetaking. Investigators also share some agreement about the distinctive processes subsumed by the term, encoding, (Di Vesta & Gray, 1972; Fisher & Harris, 1972; Howe, 1973; Weener, 1974; Carter & Van Matre, 1975; Rickards & Friedman, 1978; Barnett et al., 1981). For example, Di Vesta & Gray, (1972) aver that encoding involves the transcription of subjective associations, inferences and interpretations during listening. Fisher & Harris (1972) opine that the learner

reorganises and transforms the input data and turns it into his own. Howe (1973) believes that encoding involves coding, integrating and transforming information. Few of these researchers stipulate the specific kinds of transformation that actually take place or how these are related to the kinds of notes produced, or to any other measurable outcome. Weener (1974) does this in a fairly general way when he proposed that the student transforms the presented message in ways which can be described as associational, conceptual and inferential; (p. 62). He observes that; (i) verbatim notes are evidence of associational transformation; (ii) chunking, coding and organising result from conceptual transformations; and (iii), rules and inferences indicate inferential transformation. Barnett et al. (1981) offer the most process-oriented description of what encoding for notetaking involves, and identify paraphrasing and selection of information as crucial.

However, when evidence is sought to support these interpretations of encoding processes, it is scant. This is because the empirical investigations to back them have not been carried out. The paucity of this kind of information was highlighted a decade ago, (Hartley & Davies, 1978; Rickards & Friedman, 1978) and the still unchanged situation is lamentable. Kiewra (1985a) while observing that the comparative analysis of the process and product functions of notetaking are myopic and incapable of advancing instructional utility, insists that researchers must focus on how students ought to take notes. Unfortunately, this good advice cannot be heeded unless the question of how students actually take notes is first understood. Answers to such a question will also be invaluable for building a comprehensive theoretical model, something which to date has not emerged from the literature. Most of the research in-fact has been concerned with identifying fairly static factors which are related to notetaking. These include cognitive variables such as ability, prior knowledge and memory span. Biographic factors such as age and gender have also been shown to relate to notetaking behaviours. Thirdly, factors within the lecture, for example, information density, presentation rate and message organisation have been implicated in notetaking and recall.

The more active components of notetaking activity are examined in the present study and the relationship of structural cognitive variables e.g. prior knowledge and language ability, with actual processes deployed is analysed.

The emphasis in this study on cognitive factors and processes is not meant to convey the impression that notetaking activity is solely cognitive or that the only important cognitive factors are those that relate to ability. However, it is reasonable to claim that a substantial, if not major, part of the notetaking enterprise is cognitive. A significant step towards understanding the activity as a whole ought therefore to be possible through examination of notetaking processes within an information processing framework. The approach used for this ostensibly questionnaire study was in fact rather different from other studies which have used notetaking practices questionnaires. First, the questions were asked immediately following a live lecture when cognitive processes would still be warm and a degree of real insight rather than just opinion would be possible. Second, the questions themselves were pitched at the level of microprocesses, as well as at the level of macroprocesses as tapped in previous work. The aim therefore was an immediate retrospective reconstruction of cognitive processes employed in recording notes in a lecture which students had heard only minutes earlier, and in particular to show how knowledge (familiarity) and language ability may be related to the deployment of these processes.

6.2 FRAMEWORK FOR THE STUDY

In the present study, notetaking is conceptualised as comprising input (classifying), processing, product and outcome variables. While earlier studies have concentrated on the input and outcome aspects of the activity, examination of the relationships among all four groups of variables was undertaken here. The pivotal point from which this examination was conducted was the cognitive processes themselves, of which the number of words in notes is the most visible and commonly used in the research. Although note volume (i.e.

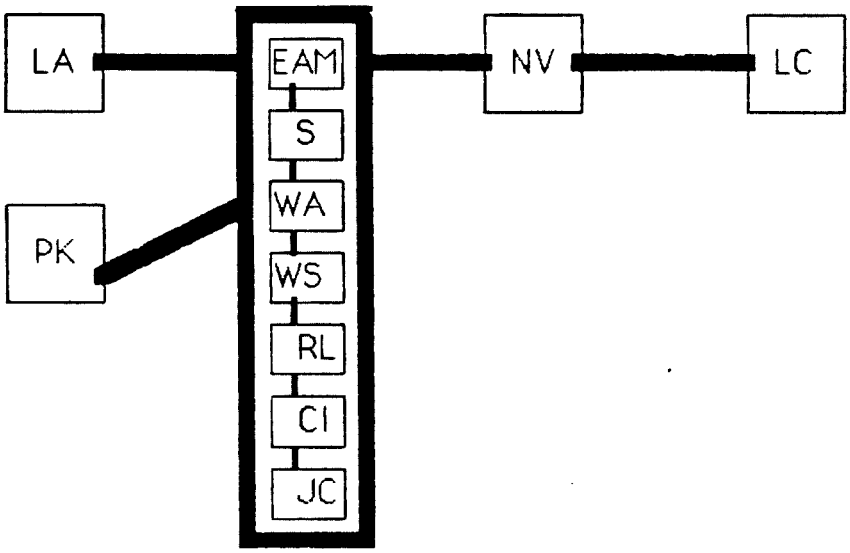
number of words in notes) is commonly treated in the literature as a process variable, it can also be treated as an intermediate product variable as in this study. More generally, when note volume is directly linked to performance on an outcome variable such as recall or comprehension but without note review, the emphasis is on notes-as-process. But when notes are used for review before recall, the product function of notes is being highlighted.

With regard to notetaking as opposed to note-reviewing, the the ratio of number of of words to time taken can be seen as a true process variable. But when, as in the present study, production time is not strictly controlled or measured, note volume is best regarded as a measure of processing product.

Figure 6.1

Framework for Study 2

Variables → Input Processing Product Outcome



Key

LA Language ability
PK Prior knowledge

EAM Effort After Meaning
S Scaling
WA Writing All
WS Writing Selectively
CI Change Ideas
RL Relate to Life
JC Judge then Change

NV Note Volume
LC Lecture comprehension

The operationalization in the present study of note volume as a measure of processing product is in line with the notion of process sequencing in notetaking activity. The production of notes is construed as, technically, the final act in the processing chain representing the culmination of all processes deployed in the activity and as propaedeutic to the comprehension product as revealed in some retrieval measure.

This thinking is discernible in the framework adopted for the present study shown in Figure 6.1 which treats notetaking as an activity related to input, processing and outcome variables. Language ability (LA) and prior knowledge (PK) constitute the input variables which were conceived as operating at zero time i.e. on presentation of the stimulus material (gender and age included in some of the analysis are also seen as input variables). Processing of lecture material was conceptualised as comprising processes which are highly interrelated. These processes may operate simultaneously, in parallel or in cascade (see 6.4.3). The processing product was deemed to be directly related to the outcome. The outcome variable is construed as immediate comprehension or recall.

6.3 METHODOLOGY

6.3.1 Subjects

Eighty second year students of a college of Education in Lagos, Nigeria, participated in the study. The sample comprised sixty-seven male and thirteen female subjects whose ages ranged from sixteen to thirty years.

6.3.2 Materials

The following information and materials were gathered and used in the present

study.

(a) A short questionnaire eliciting information on biographic factors (age & gender), and prior knowledge of psychology. Prior knowledge was scored using a 4-point scale of familiarity with psychology ranging from very unfamiliar = 1, through unfamiliar = 2, and familiar = 3, to very familiar =4.

(b) Language ability (LA) scores for each student, extracted from college records. The scores were obtained at GCE ordinary level or any equivalent examinations which justified entry into the college. Language ability which is a continuous variable, was scored on a 9-point stanine scale ranging from 9 for best performance to 1 for worst possible performance.

(c) A twenty-four minute video-taped lecture on introductory psychology was the stimulus material. The history and description of the current divisions within the subject were simply examined. The lecture was prepared by a senior member of staff in the department and ten research students in the same department affirmed its content validity.

(d) A notetaking processes inventory comprising twelve items.
Response alternatives to eight items on the inventory (EAM, S, WA, WS, RL, CI, JC, UI) were of the five point Likert-type scale from strongly agree to strongly disagree. The response alternatives for the other four inventory items (SC, NV, NN, LC) were categoric. A five-level scoring system was utilised for all the items. Scale polarity matched the literature on ideal notetaking practices. For example, the Effort After Meaning item, ("I attempted to understand the meaning of what the lecturer may be saying"), was scaled: strongly agree = 5, agree = 4, not sure = 3, disagree = 2, strongly disagree = 1.

In general, higher scores thus reflected deeper processing after Marton & Saljo (1976) and Entwistle (1979). The complete scoring system adopted for the inventory items is shown in Appendix 6.2. The items are described in detail section 6.3.2.1 below. Full texts of the questionnaire inventory, and lecture are reproduced in Appendices 6.1, 6.2 and 5.1 respectively.

6.3.2.1 Notetaking Processes Inventory

The twelve items in the inventory described processes integral to notetaking activity and were expected to capture these processes as closely and authentically as possible. They are not exhaustive since different theoretical positions will always posit different operations. However, the items represent the cognitive span from prior entering entering variables, through ongoing process variables to intermediate product and final outcome variables. The inventory items will be repeatedly referred to by acronyms, and for this reason the action or process to which each refers is now described.

Effort After Meaning (EAM) = extent of attempt to understand the meaning in the lecture.

Judging Importance/Scaling (S) = scaling of ideas for importance.

Scaling Cues (SC) = cues employed in determining importance of lecture points.

Wrote All (WA) = extent of non-selective noting.

Wrote Selectively (WS) = degree of selective noting.

Relate to Real Life (RL) = measure of integration of prior knowledge in notes.

Changing Ideas (CI) = degree of transformation of lecture material into own words.

Judge then Change (JC) = measure of extent of scaled transformations (i.e. establishing importance before transforming into own words).

Unchanged Ideas (UI) = extent to which ideas were unchanged i.e. not transformed from form in lecturer's delivery.

Note Volume (NV) = Proportion of lecture time (100/75/25%) spent recording notes.

No-Notes (NN) = lecture segments where notes were not taken.

Lecture Comprehension (LC) = assessment of how well the lecture was comprehended.

There were thus four types of items on the inventory, namely process, classifier, product and outcome, depending on the kind of information provided. Items concerned with the actual processes engaged in the production of notes were regarded as 'true' process variables (EAM, S, WA, WS, RL, CI, JC). Note volume was conceptualised as a product variable.

Three of the items (NN, SC & UI) served a secondary classificatory purpose; shedding light on specific processes to which they applied. For example, no-notes was used to clarify Note Volume, Scaling Cues explained Scaling, and Unchanged Ideas illuminated Transformations (see Appendix 6.2).

The last item on the inventory was regarded as an outcome variable because it measured the level of understanding (comprehension) attained for the lecture.

No validity and reliability measures are available for this inventory but it was developed from the Entwistle Short Inventory of approaches to studying, and from the Schmeck et al., self-report inventory of learning processes. The

validity and reliability of both instruments have been extensively documented (Schmeck et al., 1977; Schmeck & Phillips, 1982; Schmeck, 1983; Entwistle & Wilson, 1970; Entwistle et al, 1979), and there is agreement that these inventories have proved very useful in learning strategy research.

6.3.3 Procedure

Students first completed the short questionnaire which also carried information on the study together with the instructions that had to be followed (See Appendix 6.1).

The students were then instructed to watch and listen to the videotaped lecture and write notes as normally as possible. The video-lecture which had been prepared in colour by a senior academic psychologist was delivered by the researcher at an average rate of 110 words per minute. The lecture was on introduction to psychology and described very simply, the history of the subject, the kinds of questions raised and the current divisions within the discipline. Immediately after the lecture, the students completed the twelve-item Notetaking Processes Inventory.

6.4 RESULTS

6.4.1 General Characteristics Of The Sample

The mean score on self estimates of prior knowledge of psychology was 2.1 with standard deviation of .80, indicating a generally low level of familiarity with the subject.

Language ability for the entire sample was also generally low with a mean of 2.5 and standard deviation of 1.8.

6.4.2 Processes: Extent of Usage

This first level of analysis which is purely descriptive provides a global picture of the extent of usage of each of the processes by students in the sample as a whole. Mean and standard deviation scores for some of the processes investigated are shown in Table 6.1.

Table 6.1.

Process variables: Mean and standard deviation scores

	Process								
	Effort After meaning	Scaling	Write All	Write Selectively	Relate to life	Change Ideas	Judge then change	Note Vol.	Lecture Comprehension
$\bar{X}$	4.38	3.84	2.39	3.26	3.64	3.70	3.76	2.98	2.79
SD	.54	.94	1.40	1.59	1.54	1.45	1.15	1.06	1.32

Figure 6.2 shows results of item analysis on separate process variables with the use of histograms, and a summary of these results is given in section 6.4.2.1.

6.4.2.1 Summary of Results for Process Usage

1. Almost 100% of the students acknowledged they make effort after meaning.

2. Judging the importance of points transmitted was agreed by 76.7% of the subjects.

3. Nearly half the students stated that they recorded all ideas, regardless of claims about having assessed such ideas for importance (see 4 below).

4. Almost two-thirds of the subjects indicated they had selectively noted important points only.

5. A little over two-thirds of the students claimed that they related lecture material to relevant real life situations.

6. Nearly 80% of the students indicated a tendency to transform ideas into their own words in notes.

7. For 75% of the sample scaling ideas for importance preceded transformation.

8. There was approximation to a normal distribution in the amount of notes claimed to have been taken.

Figure 6.2 Process Usage

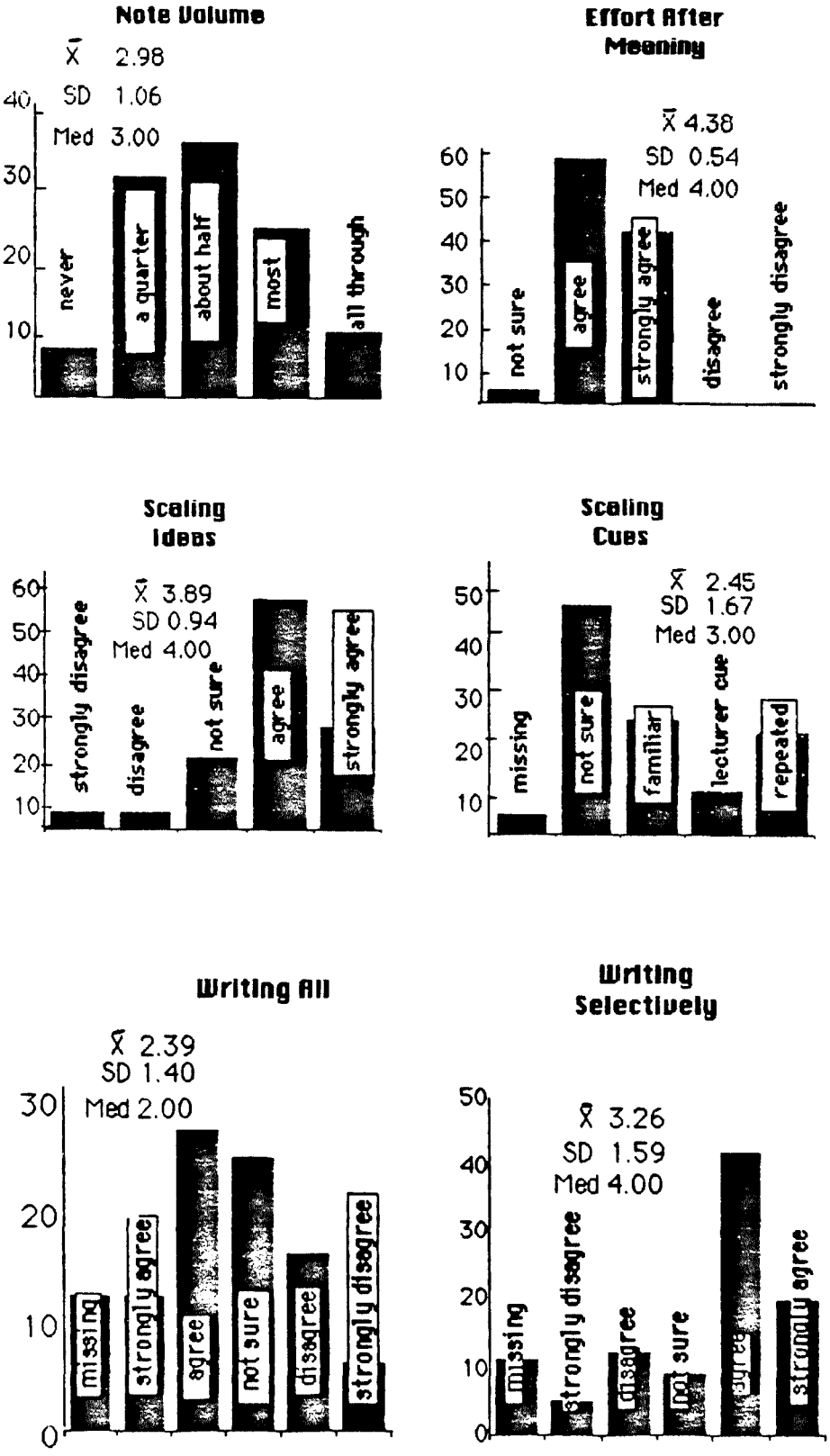
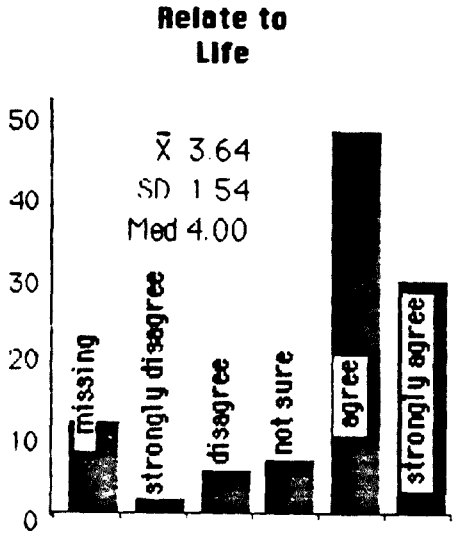
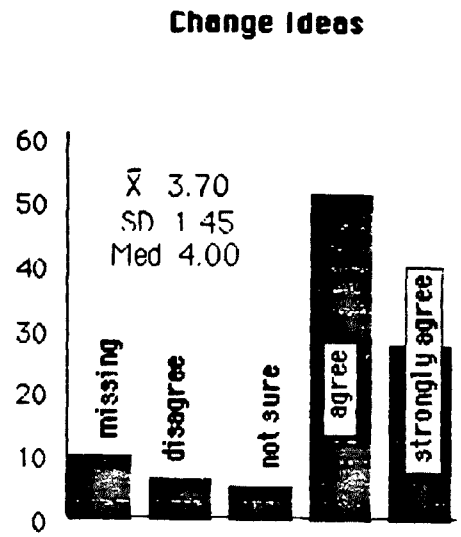
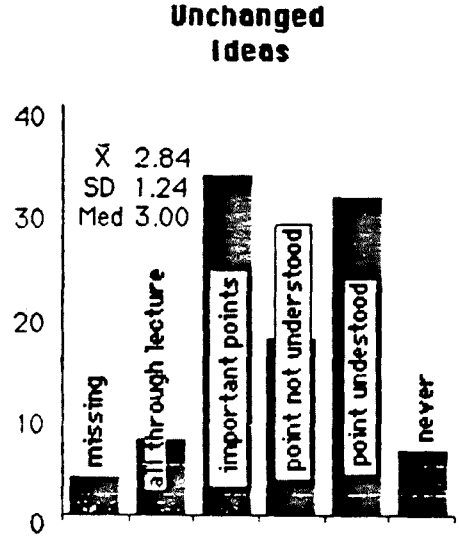
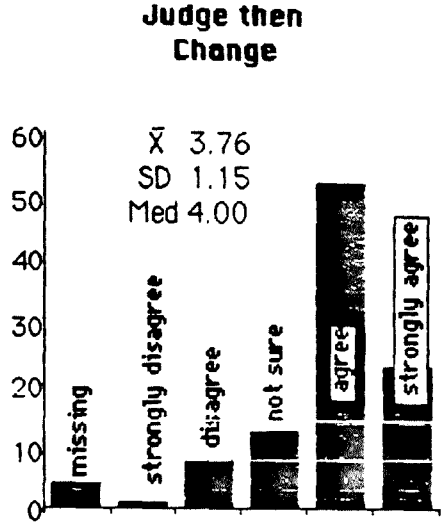


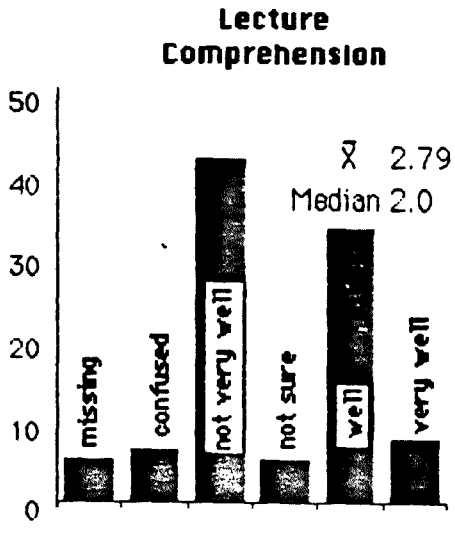
Figure 6.2 *Cont'd* Process Usage











6.4.3 Intercorrelations Among Variables

We turn now to correlations to show the nature of relationships among the four groups of variables namely; input, process, product, and outcome.

This second level analysis involves describing and explaining the nature of relationships among all the factors (variables) investigated in the study using Pearson product moment correlations. This analysis of correlations in the whole sample offers a valueable backdrop for the analysis involving separate treatment of subgroups carried out later.

As the figures in Table 6.2 show, neither gender nor age were related to any of the process or outcome variables. Older subjects showed a tendency towards spending less time recording notes (r = - .23). Familiarity (claimed prior knowledge) was found to be related to two process variables (Writing Selectively and Relate to-life) and to the outcome (LC). Among subjects who claimed to know some psychology there was a small tendency to note important points only (r = .18) and to relate lecture points to real life situations, (r = .27). they also scored higher on final comprehension, (r = .25).

The values in Table 6.2 also show surprisingly that language ability was not found to be associated with lecture comprehension. But students with high language ability tended more to assess lecture ideas for importance (r = .20) and write more selectively (r = .28). Time spent recording notes increased as students' claims of having judged the importance of points heightened, (r = .21), but decreased as the tendency to write all increased, (r = -.29). The positive but low correlation between note volume and the transformation of scaled ideas, (r = .19), suggests that students who transform ideas deemed to be important wrote more notes.

Table 6.2 General data: intercorrelations among input, process, product and outcome variables

	Gender	Fam	Age	NV	EAM	S	WA	WS	RL	CI	JC	LC
Gender												
Fam	.208*											
Age	-.210*	-.065										
LA	-.05	.141	-.100	.171	-.035	.195*	-.276**	.147	.064	.022	.161	.111
EAM	-.055	-.167	.063	.173								
S	.053	.047	-.068	.214*	.310**							
WA	-.001	-.066	-.098	-.293**	-.230*	-.341**						
WS	-.052	.181*	.059	.170	.002	.24*	.119					
RL	-.029	.274**	.097	.065	.013	.120*	.290**	.740***				
CI	.021	.088	-.041	.111	.114	.132	.394***	.692***	.796***			
JC	-.146	-.046	.163	.193*	.187*	.443**	-.382***	.381***	.237*	.207		
NV	.107	.123	-.228*	-	.173	.214*	-.293**	.170	.065	.111	.193*	.360***
LC	.046	.246**	.010	.360***	.132	.317**	-.167	.172	.161	.085	.225*	

* p = .05

** p = .01

*** p = .001

Key:

Fam = Familiarity with Psychology
S = Scaling
WS = Write Selectively
CI = Change Ideas
NV = Note Volume
EAM = Effort After Meaning
WA = Write All
RL = Relate to Life
JC = Judge then Change Ideas
LC = Lecture Comprehension

Engaging in either scaling (r = .32) or judging and transforming ideas into own words (r = .23) was associated with enhanced lecture comprehension. Also, the more time students spent writing notes, the better their claimed understanding (r = .36).

Writing Selectively was found to be highly correlated with transforming lecture ideas into own words (r = .69) and integrating prior knowledge (r = .74) both of which were highly related (r = .80), none of these variables (WS, RL, & CI) was significantly related either to note volume or lecture comprehension.

In summary, the biographic factors of age and gender were inactive in relation to either processes, product or the outcome. Familiarity with psychology was however related to the tendency to scale lecture ideas and integrate relevant prior knowledge.

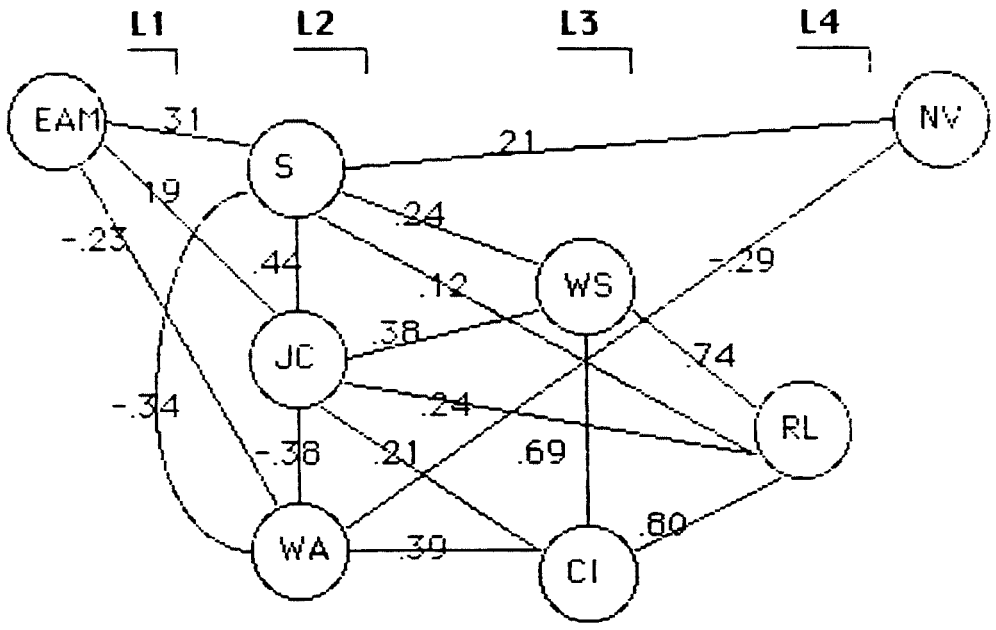
Language ability was associated with assessing the importance of lecture points and the recording of all ideas. Lecture comprehension was linked to the amount of time spent taking notes, the extent of scaling (of lecture points) and the degree of scaled transformations in notes.

6.4.4 General Processing Model for Notetaking

A first-approximation model was constructed so as represent relations among the processing variables for the whole sample. The model offers descriptions of the nature of the relationship among the processes themselves using the concept of processing levels. It is of course based on the assumption that it is in the deployment of processes that differences in cognitive notetaking functions are operative and that these differences are manifest in the measures in use here.

Figure 6.3

General processing model for note taking



Key:

L 1-4	Processing levels
EAM	Effort After Meaning
S	Scaling
JC	Judge then Change
WA	Writing All
WS	Writing Selectively
CI	Change Ideas
RL	Relate to Life
NV	Note Volume

The ordering of operations/processes in the resultant model in Figure 6.3 was determined by the strength of correlations (given in Table 6.2) between variable pairs and orienting theoretical considerations as previously discussed.

The serial representation in the diagram is for conceptual clarity and does not imply that processes have to be rigidly serial and delayed until preceding operations are terminated.

Similarly, although the concept of levels or depths of processing is utilised in the model, the meaning is different from that taken by Marton & Saljo (1976) Entwistle (1979), Laurillard, (1978) & Biggs (1978). In the present conception deeper levels of processing implies that a) the particular processes take longer to execute and/or b) instantiation is triggered by processes which are logically prior.

Processing models and the depths (i.e. levels) represented can be described by their activation levels. Activation at various depths is characterised by the level of activation of individual processes - the nodes in the Figure 6.3 model. A node, is the locus of a single operation/process and is described as active to the extent that the process it represents is correlated with other processes.

Activation levels of nodes, depths and ultimately models will differ for different samples with these differences noticeable in the nodes and depths represented in specific processing models.

Correlations given in Table 6.2 are used to provide estimates of paths for the model in Figure 6.3. The model proposes four processing levels , L1 - L4, in a sequence of increasing depth from left to right, L1 being the shallowest level and L4 the deepest. Each level comprises at least one process. The four processing levels are identified by labels which convey in a fairly general sense the nature of processes at the specific level e.g. L1, the attentional level, consists of one process Effort After Meaning which details the degree of attention given to understanding meaning in the transmitted message. L2, the scaling

level, is composed of three processes. Level L3 is then transformation and is made up of two processes. Level L4, integration consists of only one process. The composition of the attentional and integrative levels is also consistent with findings from studies of levels of processing (Marton & Saljo, 1979; Entwistle et al, 1979; Laurillard, 1978; Svensson, 1977). Less evidence is available on the scaling and transformation levels in notetaking literature. It could be argued that Writing All, Writing Selectively, Changing Ideas and Judging-then-Changing ought to belong to one and the same processing level. However, the projection of two different levels in the model is defensible on the following grounds. First, Writing All, Writing Selectivey, Changing Ideas, and Judging-then-Changing are all fundamentally scaling tasks involving the signalling of importance of pieces of information. Second, Writing Selectively and Changing Ideas are not just different, but occur at a cognitively "higher" level because they purportedly involve transcriptions of already scaled information. In terms of processing time, it is reasoned that Writing Selectively and Changing Ideas take longer to execute and therefore qualify as deeper (or higher) than Scaling, Writing All and Judging-then-Changing.

6.4.4.1 How the Model Works

The processing depths/levels are related to one another in a quasi-sequential order. Processing is evoked by the stimulus material. This triggers Effort After Meaning. Optimal activation of this operation instantiates some or all of the processes (S, WA, JC) at the Scaling level. Scaling is accompanied by transformation and/or selective noting both of which an be enriched and embellished by integrative processes. The processing sequence can be halted at any level. So, although the model proposes a four-depth structure, actual processing models drawn for different situations and individuals could show any configuration, including a single-level one. We reason that "depth engagement" is relatable to a number of factors including: (i) Subject variables such as interest, intention, prior knowledge, language ability & mood; (ii) the quantity and perhaps quality of notes produced, and (iii) outcome measures e.g. comprehension, recall, and

incorporation into skill.

6.4.5 Familiarity, Language Ability, Note Volume and Notetaking Processes

The third and final level of analysis for the present study involved examination of the variability in processing models among different subsamples. Separate correlation matrices and processing models were constructed for the following subsamples; (i) Students who claimed knowledge of psychology; (ii) Students with no knowledge of psychology; (iii) Subjects with above average language ability; (iv) students with below average language ability; (v) "Concise" note takers; (vi) "Intermediate" note takers and (vii) "Expansive" note takers.

These particular subgroups were chosen for various reasons. For example, it is persistently and convincingly argued by schema theorists and researchers in the area, that prior knowledge makes a difference in performance. Further, research on notetaking (Peper and Mayer, 1978, 1986) suggests as does evidence from other areas (reading comprehension and experts research), that (a) the processing of familiar material is distinctly different from that of unfamiliar material and (b) that kinds of material recorded in notes is generally a function of prior knowledge. They found that ability, and verbal ability in particular exerted a similar influence on notetaking and recall as did prior knowledge.

Again, the processing models diagrammatically represent the significant correlations among process and product variables for each of the subgroups. In this section, a summary of findings is given for each of the selected groups on the nature of the following relationships:

a) Input with process and outcome variables;

b) Processes with product and outcome variables;

c) Product with outcome variables.

Note however that in the corresponding diagrammatic representations, only relationships among the processing variables are shown since these are the main concern here.

6.4.5.1 Prior Knowledge and Notetaking Processes

For this analysis, students were placed in two groups based on their claimed familiarity with psychology. Students whose familiarity score was above the mean were regarded as high knowledge subjects and those with below average scores as low.

6.4.5.1.1 Notetaking Processes for High Knowledge Students

Table 6.3 shows intercorrelations among all the variables and Figure 6.4 represents relationships among processing variables for twenty-four subjects who claimed some knowledge of psychology.

Summary of Findings

1. All four processing levels were activated.

2. Scaling was the most active process.

3. Note volume was not related to any process variable, including lecture comprehension.

4. Lecture comprehension was related positively only to Effort After Meaning, (r = .48) and Scaling, (r = .41).

It would appear that for subjects who are familiar with lecture material, the amount of notes taken does not reflect the processes instantiated or the level of comprehension achieved. More crucial than recording, the results suggest, was the attention given to the material and scaling of ideas as heard.

These results are important because they indicate that for students who had some familiarity with lecture material, all the processes with the exception of Effort After Meaning and Scaling, were unrelated to note volume or lecture comprehension. As we now see, this was not the case for fifty-three students who had no knowledge of psychology.

Table 6.3 Intercorrelations among variables for the high knowledge sub group (n = 24)

	Gender	Age	NV	EAM	S	WA	WS	RL	CI	JC	LC
Gender											
Age	-.06										
EAM	.16	-.22	.08								
S	.21	-.21	.24	.36*							
WA	-.05	.20	-.19	-.10	-.39						
WS	.20	-.18	.26	-.06	.29	-.19					
RL	.04	-.19	.03	.03	.34*	.28	.47**				
CI	.09	-.07	.03	-.06	.38*	.04	.67***	.78***			
JC	-.03	-.06	.24	-.11	.44**	-.33*	.42*	.03	.50**		
NV	.21	-.36*	-	.08	.24	-.19	.26	.03	.03	.24	
LC	-.11	-.29	.13	.48**	.41*	-.06	.04	.04	.17	.00	

NV = Note volume
EAM = Effort after meaning
S = Scaling
WA = Write all
RL = Relate to life
CI = Change ideas
JC = Judge then change ideas
LC = Lecture comprehension
WS = Write selectively

*p = .05
**p = .01
***p = .001

Figure 6.4

Processing model for high knowledge students

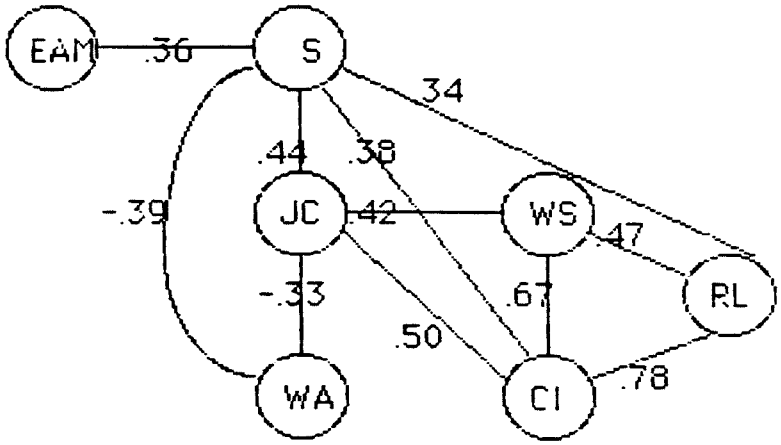
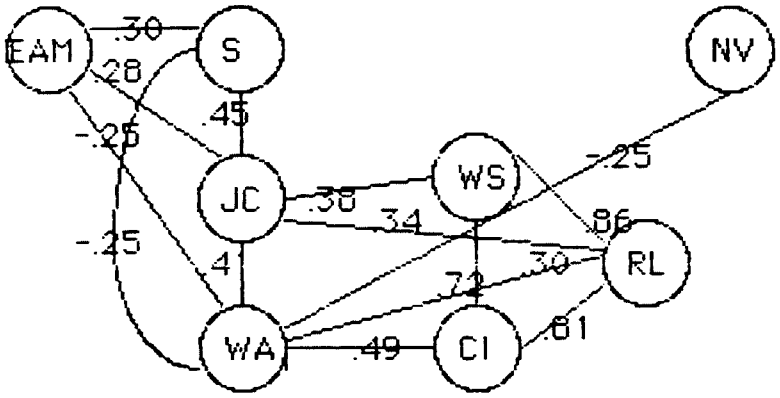


Figure 6.5

Processing model for low knowledge students



Key:

EAM	Effort After Meaning
S	Scaling
JC	Judge then Change
WA	Writing All
WS	Writing Selectively
CI	Change Ideas
RL	Relate to Life
NV	Note Volume

Table 6.4 - Intercorrelations among variables - low knowledge subjects (n = 53)

	Gender	Age	NV	EAM	S	WA	WS	RL	CI	JC	LC
Gender											
Age	-.25*										
EAM	-.17	-.13	.20								
S	-.05	.00	.11	.30**							
WA	.04	-.16	-.25*	-.25*	-.34**						
WS	-.23	.16	.10	.02	.20	.23*					
RL	-.14	.19	.08	.08	.19	.30**	.86***				
CI	-.03	-.02	.09	.20	.07	.49***	.72***	.81***			
JC	-.18	.22*	.09	.28*	.45***	-.41***	.38**	.34**	.15		
NV	-.01	-.20	-	.20	.11	-.25*	.10	.08	.09	.09	
LC	-.02	.14	.34**	.00	.28*	-.16	.17	.16	.11	.34**	

* p = .05
** p = .01
*** p = .001

Key:

Fam = Familiarity with Psychology
S = Scaling
WS = Write Selectively
CI = Change Ideas

EAM = Effort After Meaning
WA = Write All
RL = Relate to Life
JC = Judge then Change Ideas
LC = Lecture Comprehension

6 . 4 . 5 . 1 . 2 Notetaking Processes for Low Knowledge Students (see Table 6.4 and Figure 6.5)

Summary of Findings

1. Processes at all processing levels were instantiated.

2. Writing All was the most active process.

3. Note Volume was negatively related to Writing All (r = -.25).

4. Three processes were related positively to lecture comprehension;
   Note Volume, (r = .34); Scaling, (r = .28) and Judge and
   Change ideas (r = .34).

The high level of activation which characterised Writing All suggests that intensive non-selective recording of ideas occurred. This was accompanied by a reduction in actual time spent taking notes, as presumably, more ideas were missed. The results suggest that scaling and note volume were important for lecture comprehension. It is significant that note volume was the variable most highly correlated with the outcome (LC).

These students with no knowledge of the subject (Psychology), engaged intensively in writing down all the ideas transmitted in the lecture although the processes which were found to be positively linked with comprehension were judging the importance of lecture points (r = .34) and extensive notetaking (r = .34).

Among both high and low knowledge groups, scaling was related to the outcome variable (LC) . Whereas Effort After Meaning was most strongly related to lecture comprehension for familiar subjects, Note Volume had a similar

relationship among students unfamiliar with the subject matter.

6.4.5.2. Language Ability and Notetaking Processes

There is little doubt that language ability is implicated in any kind of processing of verbal material.

Students' language ability scores were classified as high or low for this analysis. Scores below the mean (2.5) were regarded as low, and those above the mean, high.

6.4.5.2.1 Notetaking Processes for Students with Low Language Ability (LA) (see Table 6.5 and Figure 6.6)

Summary of Findings

1. Familiarity was related to one process; tendency to relate lecture ideas to real life ((RL) r = .30).

2. Processes at all four processing levels were instantiated.

3. Writing All and Relate to Life were the most active processes.

4. These most active processes (WA, RL) were negatively related to Note Volume, (r = -.32, -.30 respectively).

5. Lecture Comprehension was positively related to Note Volume, (r = .40) and Scaling, (r = .35).

Table 6.5 - Intercorrelations among variables for subjects with low language ability (n = 27)

	Gender	Age	Fam	NV	EAM	S	WA	WS	RL	CI	JC	LC
Gender												
Age	.00											
Fam	.24	-.10										
EAM	.08	-.20	.07	.11								
S	-.07	-.33*	-.01	.07	.35**							
WA	.07	-.12	-.02	-.32*	-.16	-.24						
WS	.09	.10	-.06	-.07	-.02	.19	.08					
RL	-.03	.01	.30*	-.30*	-.09	.05	.42**	.61***				
CI	.13	-.16	.10	-.23	.03	.08	.45**	.57***	.68***			
JC	-.11	.11	-.16	.15	.11	.38**	-.34*	.47**	.18	.19		
NV	-.03	-.17	.01	-	.11	.07	-.32*	-.07	.30*	-.23	.15	
LC	.05	-.04	.25	.40**	.21	.35**	-.12	-.05	-.13	-.25	-.01	

* p = .05
** p = .01
*** p = .001

Key:

Fam = Familiarity with Psychology
S = Scaling
WS = Write Selectively
CI = Change Ideas
EAM = Effort After Meaning
WA = Write All
RL = Relate to Life
JC = Judge then Change Ideas
LC = Lecture Comprehension

Figure 6.6

Processing model for students with low language ability

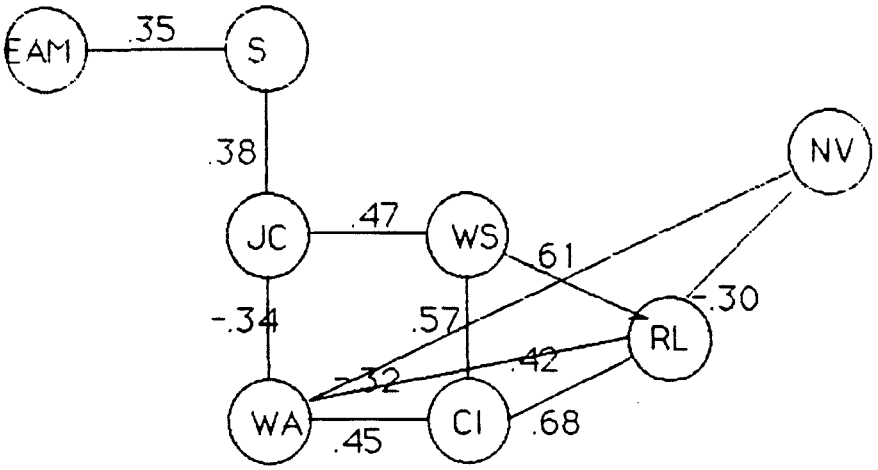
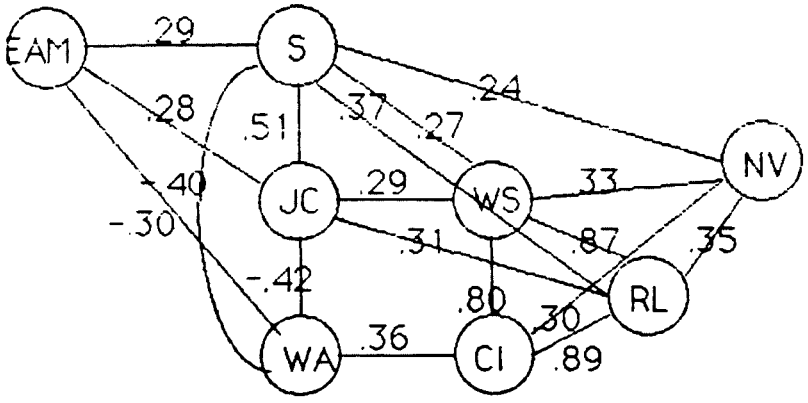


Figure 6.7

Processing model for students with high language ability



Key:

EAM	Effort After Meaning
S	Scaling
JC	Judge then Change
WA	Writing All
WS	Writing Selectively
CI	Change Ideas
RL	Relate to Life
NV	Note Volume

The results indicate that for students with low language ability, the more familiar the content was, the greater the likelihood of integrating relevant prior knowledge. But engaging in integrative processing meant less time was spent taking notes (correlation between NV and RL = -.32). Writing All was also associated with decreased note volume. A possible explanation for this result could run as follows. Intensive engagement in writing everything down in a problem situation of continuous exposition with the constraint of short term memory, could allow expansive noting of only a few of the ideas transmitted. If this happened, then a fair proportion of the information presented would not be attended to and consequently not recorded in notes. This condition may then manifest as reduced note volume. Note Volume is important among these students because the more notes the better the comprehension (r = .40). The results indicate that students with low language ability who had more notes or who assessed the importance of lecture ideas understood the lecture better.

In conclusion, the specific processes that are shown in Table 6.5 to be associated with better comprehension (NV,S) were precisely those for which activation levels were low among this group of students. The processing strategies (i.e combination of processes) used by students with below average language ability used were in fact similar to those of low knowledge students, with whom indeed there may be an overlapping set (see later comment).

6.4.5.2.2. Notetaking Processes for Students with High Language Ability (see Table 6.6 & Figure 6.7)

Summary of Findings

1. Familiarity was not related to any process, but positively with lecture comprehension, (r = .27).

2. Processes at all four processing levels were deployed.

3. All nodes were very active.

4. Note Volume was positively related to four processes; Scaling, (r = .24), Writing Selectively, (r = .33), Integration, (r = .35) and Transformation, (r = .30).

5. Six processes were positively correlated with Lecture Comprehension; Note Volume, (r =.24) Scaling, (r = .26), Selective Writing, (r =.32), Integration; (r =.38), Transformation, (r =.33) and Judging-then-Change (r =.45).

Familiarity with lecture content did not relate to any processing variable among students with above average language ability, but was correlated with the outcome variable ((LC) r = 27).

The high activation levels of nodes and processing depths signify that a great deal of interrelated deployment of processes occurred. It would appear that these students' higher ability enabled them to write more notes even though they also claimed to increasingly scale ideas and write selectively. The results also indicate that the same processes which were positively related to note volume were similarly correlated with lecture comprehension.

In summary, students with higher language ability deployed those processes that tend to produce more notes and improved comprehension. For students with either level of language ability, it is significant that the more notes taken, the better the final comprehension score. The further fact that this relationship was stronger among students with low language ability, signifies that for these students, writing extensive notes was especially critical for final comprehension.

Table 6.6 - Intercorrelations among variables for subjects with high language ability (n = 43)

	Gender	Age	Fam	NV	EAM	S	WA	WS	RL	CI	JC	LC
Gender												
Age	-.16											
Fam	.20	-.21										
EAM	-.04	.03	-.22	.21								
S	.11	.04	.02	.24*	.29*							
WA	.01	-.05	-.01	-.13	-.30*	-.40**						
WS	-.16	-.02	.20	.33**	.02	.27*	.19					
RL	-.03	.16	.12	.35**	.10	.37**	.20	.85**				
CI	-.04	.07	.03	.30*	.18	.20	.36**	.80***	.89***			
JC	-.22	.23	-.06	.07	.28*	.51***	-.42**	.29*	.31*	.24		
NV	.17	-.35**	.21	-	.21	.24*	-.13	.33**	.35**	.30*	.07	
LC	.01	.04	.27*	.27*	.08	.26*	-.15	.32*	.38**	.33**	.45***	

* p = .05
** p = .01
*** p = .001

Key:

Fam = Familiarity with Psychology
S = Scaling
WS = Write Selectively
CI = Change Ideas
EAM = Effort After Meaning
WA = Write All
RL = Relate to Life
JC = Judge then Change Ideas
LC = Lecture Comprehension

6.4.5.3 Note Volume and Notetaking Processes

On the basis of responses to the inventory item which was concerned with the percentage of lecture time actually spent writing notes, students were classified as expansive (more than 75% of the time), intermediate (about 50%), or concise (25% of the time or less) note takers. Tables 6.7, 6.8, 6.9 and Figures 6.8, 6.9 and 6.10 again show relationships among process variables and the corresponding models.

6.4.5.3.1 Notetaking Processes for Expansive Note Takers (see Table 6.7 and Figure 6.8)

Summary of Findings

1. Familiarity was related to lecture comprehension, (r = .44).

2. Three processing levels (L2, L3, L4) were represented.

3. Level of activity of all the processes was generally low. The attentional process (EAM) was not related to any other process.

4. Only one process, Effort After Meaning, was associated with Lecture Comprehension, (r = .33). The harder expansive note takers tried to get the meaning of the lecture points, the better was their comprehension.

These results thus indicate that for copious note takers the only important process with respect to final performance, was Effort After Meaning. Expansive note takers who also claimed knowledge of the subject matter, as would be expected, also showed higher final comprehension. The processing model in Figure 6.8 is consistent with the view that not much activation of processes took

place. A possible explanation within a 'Limited Capacity' model (cf. Broadbent, 1975) is that so much processing effort had to be channelled into an at least minimal understanding of the message for copious writing to be sustained that little capacity remained for more processing.

Such an attempt at explanation of course assumes within the traditional information processing framework that all processes are effortful and capacity consuming. What these data may alternatively be telling us is that when attentional effort is consumed by writing down as much material as possible, awareness and hence reportability of other background processes is reduced, and this results in poor correlations between processes as reported. This brings to light the issue of how well self-monitoring can reflect actual cognitive processes (cf. Ericsson & Simon, 1980).

Table 6.7 - Intercorrelations among variables for expansive note takers (n = 28)

	Gender	Age	Fam	EAM	S	WA	WS	RL	CI	JC	LC
Gender											
Age	-.26										
Fam	.11	-.02									
EAM	.22	-.10	-.09								
S	-.26	-.19	-.06	.29							
WA	-.05	-.01	-.02	-.08	-.37*						
WS	-.32*	.41**	-.06	-.06	.13	.09					
RL	-.39*	.49**	.20	.10	.06	.24	.73***				
CI	-.08	.15	.10	.30	.01	.33*	.48**	.58***			
JC	-.28	.20	-.20	-.08	.25	-.39*	.46**	.21	.29		
LC	.05	-.01	.49**	.33*	.14	-.15	.09	.15	.04	-.15	

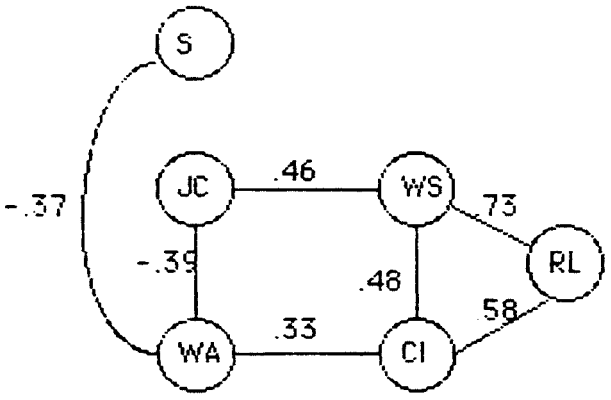
* p = .05
** p = .01
*** p = .001

Key:

Fam = Familiarity with Psychology
S = Scaling
WS = Write Selectively
CI = Change Ideas
EAM = Effort After Meaning
WA = Write All
RL = Relate to Life
JC = Judge then Change Ideas
LC = Lecture Comprehension

Figure 6.8

Processing model for expansive note takers



Key :

EAM	Effort After Meaning
S	Scaling
WA	Writing ALL
WS	Writing Selectively
CI	Change Ideas
JC	Judge then Change
RL	Relate to Life
NV	Note Volume

Figure 6.9

Processing model for intermediate note takers

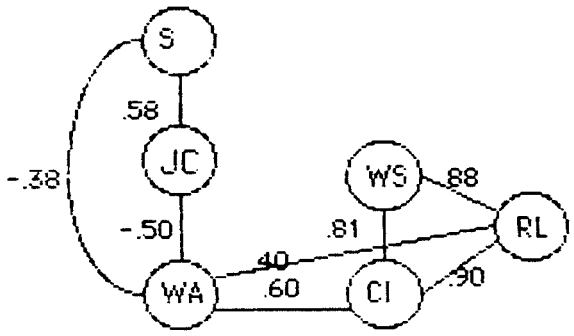
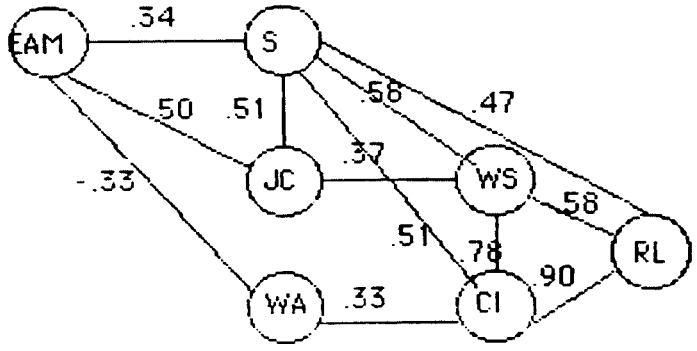


Figure 6.10

Processing model for concise note takers



6.4.5.3.2 Notetaking Processes for Intermediate Note Takers (see Table 6.8 & Figure 6.9)

The processes activation pattern is very similar to that of extensive note takers.

Summary of Findings

1. Familiarity was positively related to Lecture Comprehension, (r = .41).

2. Processes at three levels L2, L3, L4 were still represented.

3. Writing All was the most active process.

4. Lecture Comprehension was associated negatively with Effort After Meaning (r =-.32) and positively with Scaling (r =.53).

The high activation level of Writing All indicates intensive, non-selective noting of ideas by intermediate note takers. Processing at the Attentional and Scaling levels was significant for these students. Lecture comprehension decreased as paying attention to meaning heightened, and assessing ideas for importance was positively related to final comprehension.

Scaling ought to have been important for this group of students in so far as they were writing fewer notes than expansive note takers. This was indeed the case, and the results indicate that scaling was the most productive process, being the most highly, and positively, correlated with lecture comprehension.

Table 6.8 - Intercorrelations among variables for intermediate note takers (n = 27)

	Gender	Age	Fam	EAM	S	WA	WS	RL	CI	JC	LC
Gender	.										
Age	.02										
Fam	.19	-.20									
EAM	-.07	.00	.10								
S	.28	-.14	.08	.11							
WA	.12	-.10	-.18	-.15	-.38*						
WS	.16	.05	.22	-.07	.04	.29					
RL	.09	-.10	.05	-.08	.13	.40*	.88***				
CI	.12	-.05	-.04	.05	.03	.60***	.81***	.90***			
JC	-.100	.08	-.03	.14	.58***	-.50**	.26	.23	.05		
LC	.09	-.05	.41**	-.32*	.53**	-.12	.09	.09	-.02	.21	

* p = .05
** p = .01
*** p = .001

Key:

Fam = Familiarity with Psychology
S = Scaling
WS = Write Selectively
CI = Change Ideas
EAM = Effort After Meaning
WA = Write All
RL = Relate to Life
JC = Judge then Change Ideas
LC = Lecture Comprehension

6.4.5.3.3 Notetaking Processes for Concise Note Takers (Table 6.9 & Figure 6.10)

As comparison across the Figures 6.8 - 6.10 shows, the model for concise note takers was distinctive.

1. Familiarity was negatively related to Effort After Meaning, (r = -.43) and positively with Relate to Life, (r =.34).

2. There was widespread evidence at all four processing levels (strong positive correlations) of operations moving in step with each other.

3. Scaling was the most active process.

4. Lecture Comprehension was related to Judging then Changing Ideas (r = .50).

The results indicate that for concise note takers, as knowledge of the subject matter increased, attention to meaning became less necessary as evidenced by the negative correlation
(r =-.43). The activation levels of nodes, show the intensive use of scaling.

Although scaling was intensive, what was more closely associated with the outcome (LC) was not so much simple scaling as the transformation of scaled ideas (r = .50).

Table 6.9 - Intercorrelations among variables for concise note takers (n = 24)

	Gender	Age	Fam	EAM	S	WA	WS	RL	CI	JC	LC
Gender											
Age	-.05										
Fam	.39*	-.22									
EAM	-.15	.08	-.43**								
S	.32	-.02	-.05	.34*							
WA	-.09	-.33*	.14	-.33*	-.09						
WS	-.03	-.33*	.03	-.06	.58**	.16					
RL	.17	-.12	.34*	-.11	.47**	.33	.58**				
CI	-.04	-.20	.10	-.06	.51**	.33*	.78***	.90***			
JC	-.07	-.34*	-.18	.50*	.51**	-.19	.37*	.26	.31		
LC	-.03	.35*	-.03	.19	.12	.04	.19	.23	.21	.50***	

* p .05

** p .01

*** p .001

Key:

Fam = Familiarity with Psychology
S = Scaling
WS = Write Selectively
CI = Change Ideas
EAM = Effort After Meaning
WA = Write All
RL = Relate to Life
JC = Judge then Change Ideas
LC = Lecture Comprehension

In Summary, results for amount of notetaking suggest that processing of increasing sophistication occurred from expansive through intermediate to concise note takers. As seen, the change in processing pattern for the concise group was striking. The change in the processing models from expansive to intermediate note takers was small, but there was one important difference, in respect of the use to which effort after meaning was put. For copious note takers it was positively associated with final comprehension but for intermediate note takers, it was not significant. More particular points are as follows; a) Prior knowledge was important for lecture comprehension among both expansive and intermediate note takers but not for concise note takers. b) Although one process each (EAM & JC) was related to lecture comprehension for both concise and expansive note takers, these were different in kind. These two kinds of processes (attentional and scaling) were significant for final comprehension among intermediate note takers reflecting a truly median position.

6.4.6 General Summary of Interaction between Prior Knowledge, Language Ability, and Notetaking Processes

1. Familiarity was associated with lecture comprehension among students with high language ability, expansive and intermediate note takers, but not for concise note takers and subjects with low language ability.

2. Among three groups - low knowledge students, and students with high or low language ability, note volume was positively related to comprehension. This is a recurrent finding in notetaking research and would seem to provide the basis for the thinking that more notes are desirable, (Fisher & Harris, 1973; Locke, 1977; Kiewra, 1984; Kiewra & Fletcher, 1984; Kiewra, 1985a). However, for high knowledge subjects the quantity of notes taken appeared to be irrelevant, thus undermining the implied generality of such an

assertion.

3. The pattern of results in which Effort After Meaning was related to lecture comprehension was similar in high knowledge subjects and heavy note takers.

4. Scaling was significantly related to lecture comprehension in five groups - high and low knowledge students, subjects with high or low language ability and intermediate note takers, indicating that it was generally an important process.

6.5 DISCUSSION

The aim of this study was to reconstruct, examine and describe the cognitive processes that students deploy when they produce notes at lectures, and to show how certain variables of theoretical interest modulate these processes. The findings which emerged provide two distinct types of information in this regard: (i) information on extent of usage/deployment of processes for a general process model of mental operations involved in notetaking, (ii) information on how such a process model might be further identified in terms of such factors as familiarity, language ability, and most importantly, note volume.

6.5.1 Process Usage Across Students in General

The findings are in general agreement with claims by theorists about the nature and extent of processes deployed in notetaking activity, (Di Vesta & Gray, 1972; Howe, 1973; Fisher & Harris, 1972; Carter & Van Matre, 1975; Rickards & Friedman, 1978; Barnett et al., 1981). The extensiveness and in particular the

degree of similarity reported in the manner of deployment of processes provide useful insights into the activity, but also provoke concern with regard to the veracity of student self reports. The lack of variability i.e. the great similarity in the response patterns conspicuous for most of the items on the inventory causes some unease because one wonders whether the processes can be so similarly deployed in the face of weighty evidence of individual differences in problem solving (Resnick, 1979; Daneman & Carpenter, 1980). This observation echoes the difficulty posed by the use of self reports especially of mental or cognitive processes as objective and primary data, and the arguments between Ericsson & Simon (1980) and Nisbett & Wilson (1977).

6.5.2 Group Differences in Notetaking Processes

Differences can be discussed in terms of the two indices identified earlier, path density and activation levels of nodes. Using these it is possible to discuss better what was happening in the various processing models for the different kinds of students and in particular highlight similarities and contrasts.

High path density is evident in two processing models; those for low knowledge students (Figure 6.5) and students with high LA (Figure 6.7). This indicates that among both groups, many processes were instantiated and deployed interrelatedly. The activity level of Effort After Meaning was similar in both these groups with one significant difference being in the activation levels of Scaling and Writing All. Among low knowledge subjects, Writing All was the most active process whereas Scaling occupied the node of greatest activity for students with high language ability (LA). This difference meant that for one group of students (low knowledge) writing all the points transmitted in the lecture was most extensive, while assessing the importance of ideas appeared to be more important for the other group (High LA).

Writing All instead of Scaling and to a lesser extent Effort After Meaning as the most active process (node), it is suggested, may be symptomatic of inefficient strategy deployment. The reason is that under the prevailing circumstances in a live lecture, writing all the ideas transmitted seems highly inappropriate because of the limitations imposed by short term memory. Thus when Writing All is intensively activated as evidenced by significant correlations with a number of other processes, this could be a signal of inappropriate processing strategy for notetaking from lectures.

Writing All was also found to be the most active process among students with low language ability (Figure 6.6). A possible explanation for this result here is that low language ability necessitated extensive writing of all the points in the lecture possibly as a compensatory tactic. A deficiency in language ability may prohibit the effective use of processes at the scaling level with the result that all information attended to (i.e. not missed) is treated equally seriously and so recorded. The more intensively Writing All is engaged for the low LA student, the fewer will be the notes recorded for the entire lecture. The negative correlations between Writing All and Note Volume for students with low language ability (Fig. 6.6) as well as low knowledge subjects (Fig. 6.5) provide support for this position.

The processing model for students with high language ability (Figure 6.7) also qualifies as a dense model, however, the most active process is scaling. A similar pattern of results was obtained for high knowledge subjects (Figure 6.4) and concise note takers, although these two latter processing models had lower path densities. The finding that for these three groups of students scaling was the most active process would appear to explain the finding of qualitative differences in noted propositions by Peper & Mayer (1978). Students familiar with lecture material were found to have recorded more propositions of high importance. Kiewra & Benton (1988) reported similar findings for subjects with high information processing ability. Though earlier studies have shown that students differ with respect to the kinds of ideas recorded, (Kiewra & Fletcher, 1984; Einstein et al. 1985; Peper & Mayer, 1978), the possible reasons, for this have not been examined.

Low path densities and activation levels of nodes is evident in the processing models for expansive and intermediate note takers. As stated earlier, this possibly indicates low levels of awareness and reporting of other cognitive processes when substantial amounts of attentional resource is being used up by particular processes e.g. Writing All.

Thus, path density and activity levels of processes reflect important processing differences in our various sub-samples.

6.6 CONCLUSION

This study has demonstrated students' claims of extensive deployment of attentional, scaling, transformational and integrative processes in notetaking. Pronouncements by researchers in the area appear to have been supported by the data although the evidence shows that the processes are not uniformly instantiated across different groups of students.
The results which emerged suggest that moderately dense (paths) processing models where Effort After Meaning and Scaling are the most active processes manifest more efficient processing of lecture material for notetaking. It is clear that Figure 6.5 (processing model - high knowledge students) and Figure 6.10 (processing model - concise note takers) fall in this category. This position supports and advances possible explanations for Howe's (1970) efficiency principle which states that efficient notes are those in which the fewest number of words are used to represent ideas in notes.

Given some of the doubts noted earlier about the validity of self report protocols - particularly for claiming to monitor processes that may be substantially unavailable, a desirable direction of further research could be in the examination of notes to discover the extent to which processes claimed in self reports are evident in notes produced in live lectures. This is the agenda for Study 3.

A further limitation on the approach to analysis is that in order to form the subgroups the same cake was merely being cut in different ways, that is the groups had overlapping membership instead of being discrete. Some of the cross-links in results are best understood from this perspective. Thus for example the fact that low language ability and low prior knowledge were both associated with high note volume could be due to this overlapping membership, although findings by Peper & Mayer (1978) and Einstein et al. (1985)suggest that ability (language ability in particular) and prior knowledge may in fact have similar consequences for notetaking. Nevertheless, clarification of relationships implied here is also part of the agenda for Study 3.

CHAPTER 7

STUDY 3: PRIOR KNOWLEDGE, NOTETAKING AND COMPREHENSION

CHAPTER OUTLINE

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7 . 1 INTRODUCTION

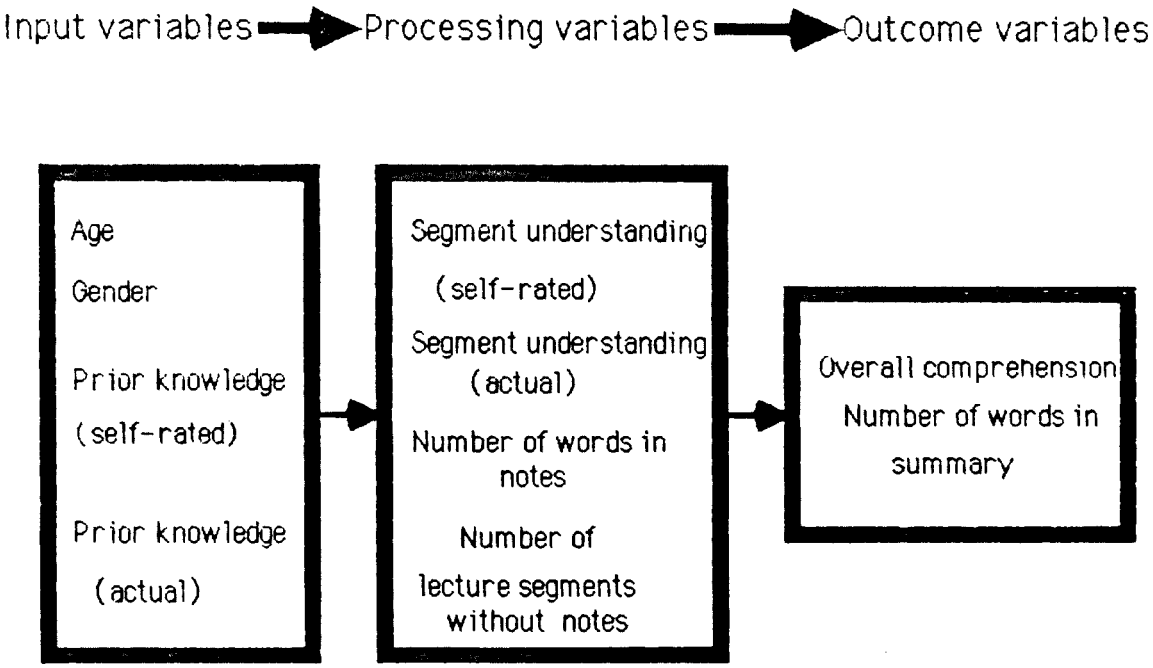
Study 2 used a post-lecture reconstruction methodology which was heavily dependent on a) effective self-monitoring of cognitive processes; b) ability to hold the result of such self monitoring in memory for some 30 - 45 minutes; c) ability to represent the results of this self monitoring veridically within the classifying or scaling requirements of the process question as asked. The present Study 3 offers an improved methodology since it depends on neither retrospective reconstruction, nor on access to cognitive processes which may be in part unavailable to conscious level monitoring.

The aim of the study was to examine the links within the notetaking system between factors conceptualized as input, processing and outcome variables. Figure 7.1 is a diagrammatic representation of the research problem.

Consider how a student of a specific age and sex with a given amount of prior knowledge listens to a stimulus lecture. The student infers the whole or partial meaning from the words heard. The student also "simultaneously" represents this understanding or lack of it in the form of written notes. But which subject input factors and subsequent processes, separately or in combination best predict the quality of comprehension as evidenced by a summary of the lecture to be produced immediately afterwards? This is the problem for the present study. The study also explores the extent to which analysis of within-lecture processes provide evidence of the processes claimed in Study 2 to be deployed in notetaking activity.

Figure 7.1

General conceptual model of research problem



7.2 METHODOLOGY

7.2.1 Subjects

The sample consisted of thirty-two females and twenty-eight males between the ages of 16 and 17 years enrolled in the sixth forms of two comprehensive schools (Stockwell Park School, London; Leon School, Milton Keynes).

7.2.2 Materials

The principal instruments were a short questionnaire and a 24 - minute videotaped lecture on introductory psychology.

7.2.2.1 The Lecture

The topic for the lecture was chosen to be of interest to the target population, namely, students enrolled in advanced level G.C.E. courses. The content and complexity of the lecture was adjusted to suit this audience.

A senior member of staff in the Department prepared and delivered a 46-minute lecture to an imaginary class with the help of illustrated 'flip charts'. The lecture was given in the psychology laboratory and was recorded on video. The lecture, which was in colour, and twenty-four minutes long was entitled Introduction to Psychology. It presented in a very simple form the history of psychology and the various areas into which the subject is currently divided. There was a total of 2,637 words delivered at an average rate of 1.83 words per second (approximately 110 words per minute). The full text is provided as Appendix 7.1.

A complete text of the lecture was produced without any punctuation . Copies of the lecture transcript were given to seven graduate students of the department who also watched the video and inserted slashes on the transcript where they expected breaks in the material. It was emphasized that the exercise was not about insertion of punctuation marks but to obtain segmentation into ideas

or "mini themes". This parsing into idea units is similar to the practice followed by Johnson (1970), Brown & Smiley (1977), Brown & Day (1981) and Athey & Worrall (1987). These graduate students were also asked to rate the importance of each segment for the theme of the lecture by assigning segments to five categories of importance as follows; 1, least important (digressive or distractive), 2, redundant, 3, peripheral, 4, explicatory, and 5, most important (central). There was a high degree of agreement on these tasks (97%).

The resultant twenty-three segments varied in length, the shortest containing sixty-one words and the longest three-hundred and two words. Eleven of the segments were rated as most important (i.e. central), five as explicatory while three and four segments were rated as peripheral and redundant respectively.

Three other graduate students then watched the lecture without benefit of transcripts. They were instructed to take written notes. The idea units written in their notes proved to correspond highly with the designated idea segments. All ten graduate students who took part in this exercise were agreed that the lecture material had high content validity.

In a further exercise to find the optimal pause between successive segments for subjects to complete the rating of understanding, two graduate students who had been involved with the earlier segmentation agreed in preferring twenty-second pauses from ten and thirty-second ones. The final video taped lecture was then produced by inserting pauses twenty seconds long between consecutive lecture segments during which the picture on the monitor was visible but "frozen".

7.2.2.2 Questionnaire

The questionnaire consisted of five items. Three of the items elicited biographical information on name, gender and age. The subjects were also required to indicate their familiarity with the subject matter of psychology so as to yield two indices of prior knowledge. The first of these was a self-rating on a five-point scale of "familiarity with psychology" ranging from very unfamiliar to

very familiar. A written note on what they thought psychology was about provided the basis for the second index of prior knowledge. The questionnaire can be seen in Appendix 7.2.

7.2.3 The Variables

As Figure 7.1 implies, scores were obtained for each student on the following variables: (The acronyms used for each variable are also given).

(i) Two ratings of prior knowledge of psychology;
    a) self-rating (PK(S)), and
    b) researcher rating (PK(A)).

It was expected that background knowledge would be related to overall comprehension. This position is popular among schema theorists (Ausubel, 1968; Rumelhart & Ortony, 1977; & Anderson, 1984), who hold that the most important factor in learning is the knowledge base which a learner brings into the learning situation.

As indicated above, prior knowledge was measured in two different ways i.e. by student self-estimates and by researcher scoring of written comments. This was done for two reasons. First, to depart from the teacher-centred nature of learning research that has gone on for so long, and in keeping with recent research emphasis, to inquire from the student about his own learning. Secondly, the availability of these two indices allowed the comparison of both and an examination of the relationship of either with overall comprehension. Prior knowledge was measured using a five-point scale of familiarity with psychology ranging from very unfamiliar (1) to very familiar (5). The scale can be seen in Appendix 7.2.

ii) Self-rated understanding for the twenty-three lecture segments (SU(S)).

Students were required to monitor and report their understanding of consecutive lecture segments by using a five point scale ranging from "definitely understood" to "definitely not understood," see Appendix 7.2.

iii) Segment understanding: researcher rating (SU(A)).

Notes written for each segment of the lecture were scored by the researcher using the same scale as that used for measuring self-rated understanding. Notes were scored by matching the content of segments against the corresponding units in the original lecture. When, as sometimes, students greatly condensed notes, they were scored as probably understood if the word(s) used were the same as, a synonym, or a close relative of those used by the lecturer. In fact very few synonyms were used.

As a reliability check, two independent judges (the researcher and the lecturer who delivered the lecture) scored a sample of students' notes and achieved a high degree of agreement (93%).

Though most notetaking studies have not included monitoring for understanding, it was reasoned that judgements about processing could not adequately be made without a measure of within-lecture understanding. Processing is both a function of and a reflection of the type of understanding reached at that point in the lecture. It was also considered useful for students to monitor their own understanding so as to provide both an "objective" and a "subjective" index.

v) Total number of words in notes (WN).

It has been repeatedly found in notetaking studies (Crawford, 1925 a&b; Locke, 1977; Nye, 1978; Howe, 1970) that words/ideas written in notes are related to goodness of recall. But whereas some researchers report findings in favour of more words (Kiewra, 1988; Anderson & Armbruster, 1986; Pauk, 1984), others notably Howe (1970) find the reverse. Inclusion in the present study of this

measure was therefore taken as sensible and routine.

The total number of words in each student's notes was counted. Abbreviations were counted as if they were written in full, for instance '&' was counted as one word, while "C17th & C18th" was deemed to constitute five words.

v) Number of lecture segments with zero notes (SZN).

Listeners do not write notes on every bit of information transmitted. Recording the number and the type of segments without notes was expected to be helpful in an attempt to explain notetaking activity.

vi) Total words in final summary (WS).

The number of words used in the final summary was counted in the same manner as words in notes.

7.2.4 Procedure

The researcher was introduced in both schools by the respective heads of sixth form as "a teacher and researcher". The students were informed that the investigator was interested in finding out "how students learn during lectures", that they were going to watch a video lecture on psychology and that the lecture would freeze or be "held" for twenty seconds at the end of each paragraph. The students were instructed to take notes in their normal way during the lecture and then during the pause, score in the margin on a 5 - point scale how well they had understood that paragraph. The students had a trial run on the first segment and a longer pause to ensure that the instructions had been assimilated.

Four sheets of ruled paper were provided for each student to write notes, all notes were collected at the end of the experiment.

Immediately after watching the video, students were asked to write a free recall summary of the lecture in ten minutes. Most students completed their summaries in less time. These summaries constituted the criterion measure for overall comprehension.

7.3 RESULTS

The pattern of data from the two classes was very similar and they are accordingly treated as a single group.

The data were analysed by correlational and multiple regression analysis. In addition, contingency table analysis was used to provide different perspectives on the same data. Multiple regression analysis which focuses on amount of change in one variable with unit change in a prior variable was employed to address more directly the question of causal linkage. Causal analysis was helped by the fact that input, process and outcome variables had a natural temporal sequence and that the analysis method allows rival influences to be partialled out. Contingency table analysis is evidently concerned with 'frequencies of cases', and it was expected that much of the data could be usefully looked at in this way. The results are presented using the framework outlined in Figure 7.1, that is, by examining the relationships between the input, processing and outcome variables.

7.3.1 General Points

Notes from most of the students contained the essential content or gist of the lecture, although segments without any notes were fairly common. Forty-eight of the 59 students did not take notes in at least one segment of the lecture, and two students wrote no notes whatever for the whole lecture.

Very few notes contained information outside that explicitly given in the lecture. As an example of imported information, notes corresponding to the third segment of the lecture for three students were as follows (underlining indicates material not given in the lecture).

Segment	Note taken
1	"English Philosopher - from 1650 - 1750
2	English Philosophers from 850 - 1750'
3	C17th Eng. Philosophers. What is mind? What is conscience? and asked and attempted to find solutions. Believed external factors affected conscience or external stimuli. Like POSITIVISTIC THEORY in Sociology."

These occurrences were very few but provide instances where prior knowledge was evident within notes and therefore of importance in the present study.

Inaccuracies in notes were also rare, misrepresentations of the kinds specified below occurred in four out of fifty-nine notes:-

"North American Psychology" appeared as "South American Psychology" in two sets of notes; "Physiological psychology" became "Chemical psychology" in one instance; and "English Philosophers" was represented as "English psychologists", also in one case.

7.3.2 Assessing The Conceptual Model

The Pearson correlation coefficients among all the variables investigated in the present study are given in Table 7.1. The same information is represented in Figure 7.2, now set within the framework of the orienting model for Study 3.

These correlation-based relationships are now briefly discussed before turning to the main analysis using multiple regression methods.

7.3.2.1 Correlation Analysis

This analysis was useful in showing the nature of relationships among variable groups and in preparing the way for multiple regression analysis reported later.

Neither age nor gender was related to prior knowledge. The lack of a relationship between age and prior knowledge suggests that the lecture contained domain specific-knowledge to which subjects had not yet been exposed. However, age and gender did link to two processing variables. First, gender was negatively related to number of words used in notes ($r = -.28$), so that females wrote more copiously than males. Second, older subjects had more no-note segments. Unlike age and gender, the other input variables (self-rated prior knowledge and researcher-rated prior knowledge) associated to both processing and outcome variables. These two indices used to assess prior knowledge were positively also correlated ($r = .59$), showing that subjects' estimates reasonably agreed with the researcher's scoring of their prior knowledge. However, as Figure 7.2 shows, self-estimated prior knowledge was positively related to the mean of self-rated understanding for all twenty-three segments of the lecture ($r = .22$), but not to the mean of researcher-rated understanding. Thus when a student estimated him or herself as having high prior knowledge of psychology, average self-rated understanding of the lecture was also high, but not understanding as reflected in notes rated by the researcher.

Actual (researcher-rated) prior knowledge was not related to any of the processing variables, but only with the outcome variable, overall comprehension ($r = .53$). This analysis thus shows that this index of prior knowledge (PK(A)), was more strongly related to overall comprehension, than students' self-estimate (PK(S)) although this was also positively correlated with the outcome ($r = .33$). This result could be explained in terms of the stability of a cognitive response once one has been made, (cf. Howe, 1970b).

Figure 7.2 also shows that the processing variables themselves were highly inter correlated. Within-lecture understanding, whether self-rated or actual was positively related to the number of words used in notes(r =. 28, . 54) and negatively related with the number of segments without notes (r = -.36, -.27). Simply interpreted, these results imply that better understanding was paired with more words in notes and poorer understanding with more or un-noted segments.

Two of the four processing variables were related to the outcome variables. Actual mean segment understanding was positively related to overall comprehension (r = .25), while the total number of words in notes had a straight forward link with the number of words in the summary (r =.46), that is, students who wrote more during the lecture also wrote more in the summary. The positive correlation between mean segment understanding and overall comprehension (r = .25) -both researcher rated- reasonably suggests that better understanding of the lecture segments was related to higher overall comprehension. It can be seen that there is no parallel path from the mean of self-rated understanding.

The outcome variables, number of words in summary and overall comprehension were also correlated. As the number of words used in the final summary increased, overall comprehension tended to increase. This could reflect the heightened probability of making a useful point as more information was written.

Table 7.1 Intercorrelations among variables

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Age	1															
2	Gender	2	.14														
3	PK(S)	3	.13	.11													
4	PK(A)	4	.09	.01	.59***												
5	MSU(A)	5	.19	-.16	.14	.16											
6	MSU(S)	6	.04	-.17	.22**	.18	.56***										
7	MU1	7	.34**	-.20	.09	.05	.79***	.52***									
8	MU2	8	.17	-.05	.12	.09	.81***	.50***	.50***								
9	MU3	9	.09	-.12	.14	.30**	.69***	.35***	.24**	.46***							
10	CSM	10	.13	-.06	-.01	.03	.94***	.46**	.73**	.80***	.77**						
11	ESM	11	.17	-.07	.14	.12	.79***	.52***	.49***	.98***	.45***	.77***					
12	PRSM	12	-.04	.09	.01	.18	.90***	.23	.74**	.66**	.84**	.88***	.47***				
13	SZN	13	.30**	.11	.01	-.02	-.27**	-.36**	-.13	-.40**	-.32**	-.52**	-.43***				
14	WN	14	-.13	-.28**	.09	.14	.54***	.28**	.25*	.57***	.56***	.64***	.58***	.36	-.57***		
15	WS	15	-.16	-.22*	-.04	.13	.15	-.06	-.07	.17	.35**	.31**	.16	.34	-.23*	.46***	
	OC	16	.06	-.10	.33**	.53**	.25**	.15	.01	.20	.47***	.24	.16	.37	-.06	.22	.47***

* p = .05
** p = .01
*** p = .001

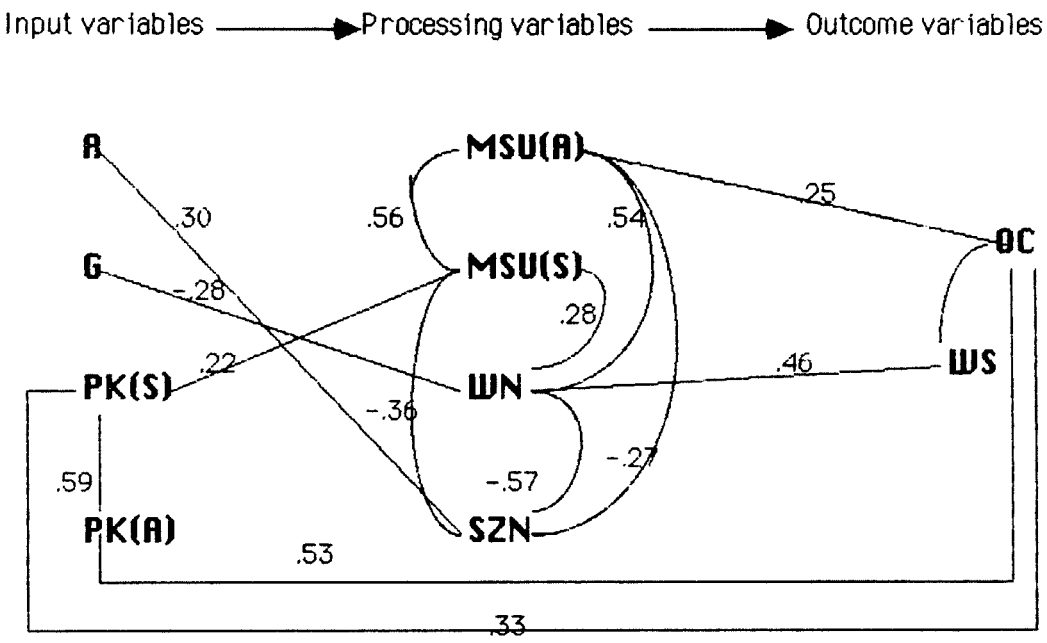
Table 7.1 cont'd.

Key:

PK(S)	=	Prior knowledge (self estimate)
PK(A)	=	Prior knowledge (actual)
MSU(S/A)	=	Mean segment understanding (self rated/actual)
MU1	=	Mean understanding, beginning section of lecture
MU2	=	Mean understanding, middle section of lecture
MU3	=	Mean understanding, end section of lecture
CSM	=	Mean understanding, segrments of central importance
ESM	=	Mean understanding, expository segments
PRSM	=	Mean understanding, peripheral and redundant segments
SZN	=	Sum unnoted lecture segments
WN	=	Number of words in notes
WS	=	Number of words in sumary
OC	=	Overall Comprehension

Figure 7.2

Correlations among the variables



$p \leq .05$

A	Age
G	Gender
PK(S)	Self-rated prior knowledge
PK(A)	Researcher-rated (Actual) prior Knowledge
MSU(A)	Mean of actual segment understanding
MSU(S)	Mean of self-rated segment understanding
WN	Number of words in notes
SZN	Number of segments with zero notes
OC	Overall comprehension
WS	Number of words in summary

7.3.2.2 Multiple Regression Analysis

The correlation coefficients identified in the preceding section and used in Figure 7.2 could not be employed in charting causal paths across the groups of variables represented in the general model shown in Figure 7.1. In developing a causal model, it is more satisfactory to look at change in target variables as a function of unit change in variables which have prior temporal, logical and indeed causal status within the conceptual model. A method is also required which allows estimation of the separate unconfounded influence of any notional causal variable on its target variable. For this reason, multiple regression analyses were conducted. The input and process variables were entered in two stepwise regression analyses and were treated as exogenous and endogenous variables respectively. In the first analysis process variables were regressed on input variables while in the second, output variables were regressed on both process and input variables.

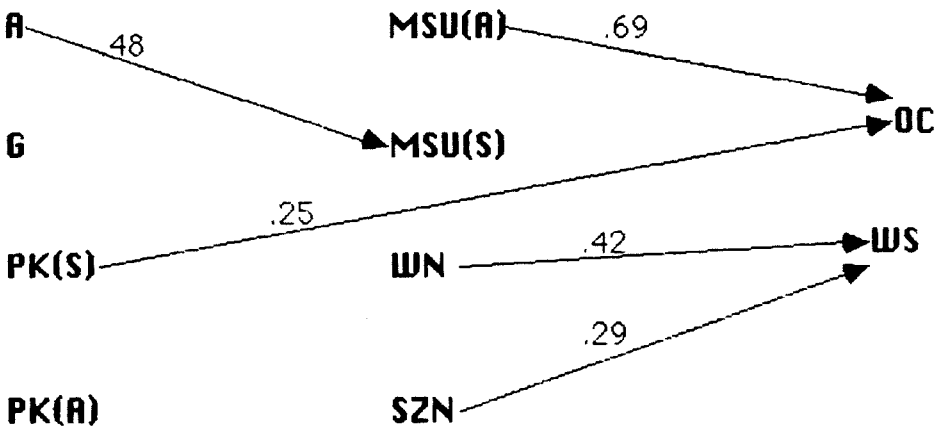
The absence of certain paths is as striking as the presence of others. The failure of prior knowledge to make substantial contact with the processing variables is an obvious case in point. The significant beta coefficients are given in the path diagram in Figure 7.3. The figure shows those links that have been "trimmed away" from the correlation-based model in Figure 7.2 on account of statistical non- significance. Paths can "disappear" when it turns out that the larger part of an apparent correlation is "explained" by an overlapping variable. For example, when individual contribution of two or more variables which are highly correlated are partialled out, the residue in the weaker variable becomes non significant.

Three of the paths from Figure 7.2 were retained. These are self-estimated prior knowledge to overall comprehension (PK(S) - OC), mean of actual lecture understanding to overall comprehension (MSU(A) - OC) and number of words in notes to number of words in summary (WN - WS). Two single-stage paths emerged, these being, age to mean of self-estimated understanding (A - MSU(S)) and no-notes to words in summary (SZN - WS).

Figure 7.3

Path diagram of causal model showing standardized regression coefficients

Input variables ⟶ Processing variables ⟶ Outcome variables



$p \leq .05$

A	Age
G	Gender
PK(S)	Self-rated prior knowledge
PK(A)	Researcher-rated (Actual) prior Knowledge
MSU(A)	Mean of actual segment understanding
MSU(S)	Mean of self-rated segment understanding
WN	Number of words in notes
SZN	Number of segments with zero notes
OC	Overall comprehension
WS	Number of words in summary

Regression Of Processing On Input Variables

According to Fig. 7.3, the relationship between input and processing variables is maintained by the influence of age on self-rated understanding. The significant coefficient implies that older students rated their understanding higher. Note however, that there is no corresponding link with actual understanding - (MSU(A)). Even more surprising is the absence of paths from either prior knowledge index to segment understanding, indicating that prior knowledge of psychology does not determine within-lecture understanding either as rated "objectively" i.e. by the researcher, or "subjectively", by the student. This carries important implications that will be discussed shortly.

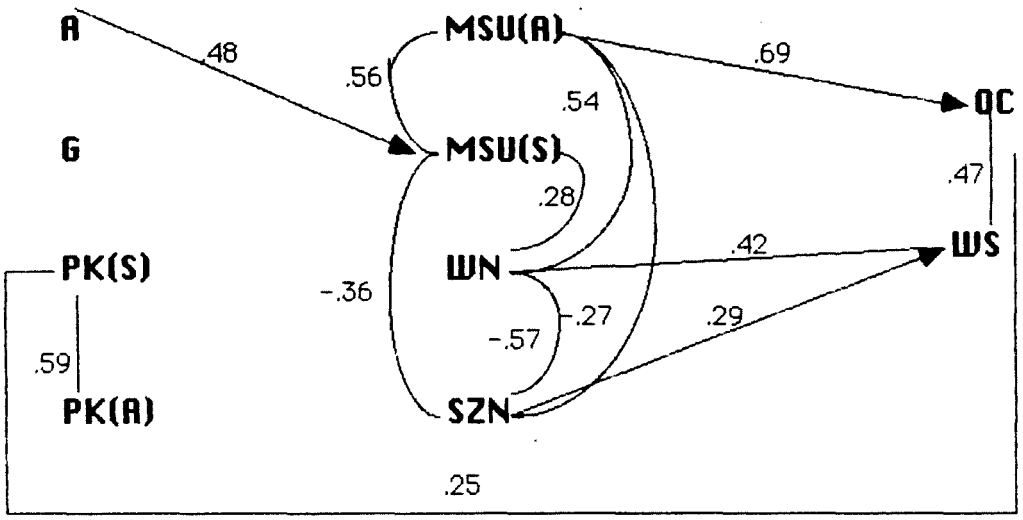
Regression Of Outcome On Processing Variables

There were three significant links between processing and outcome variables, (actual mean segment understanding to overall comprehension; words in notes to words in summary; no-notes to words in summary) and one significant path between input and outcome variables (self-rated prior knowledge to overall comprehension), This pattern indicates that the processing variables were better predictors of the criterion variables. Actual mean segment understanding (b = .69) accounted for 48% of the variance in the dependent variable, overall comprehension, (F = 46.1, df = 1, 49, P = .0000) while self-estimated prior knowledge, explained a further 6% of the variance, (b = .25, F = 29.2, df = 2.48, P = .0000).

The previous correlation-based relationship of number of words in notes with the number of words in summary is retained in regression analysis as is the relationship of no notes with the number of words in summary. The number of words in notes emerged as the only significant predictor of the number of words in summary accounting for 18% of the variance, (b = .42, F = 10.9, df = 1, 49, P = .001).

Figure 7.4

Causal and correlational relationships among input, processing and outcome variables



$p \leq .05$

A	Age
G	Gender
PK(S)	Self-rated prior knowledge
PK(A)	Researcher-rated (Actual) prior Knowledge
MSU(A)	Mean of actual segment understanding
MSU(S)	Mean of self-rated segment understanding
WN	Number of words in notes
SZN	Number of segments with zero notes
OC	Overall comprehension
WS	Number of words in summary

So far, evidence for the model has been evaluated, with the conceptual model proposed in Figure 7.1 being revised to produce the more precise model of Figure 7.3. It is most important to note however that these regression results do not compromise the "vertical" or within-group correlations in Figure 7.2. As stated earlier, these relationships are not part of the causal modelling procedure which is only concerned with the "horizontal" linkages across Figure 7.3. Accordingly, the overall best picture is provided by Figure 7.4 which shows both horizontal causal paths and vertical non-causal relationships. Figure 7.2 is best seen as the initial stage in the development of the final model represented by Figure 7.4.

7.3.3 Prior Knowledge, Number Of Words In Notes, and Comprehension

To improve on the global picture of aspects of processing and notetaking presented so far, and in particular to examine further the nature of the influence of prior knowledge, another series of multiple regression analyses was conducted.

The literature takes for granted and indeed demonstrates (cf. Peper & Mayer, 1978, 1986) that prior knowledge influences comprehension. For this reason, separate analysis were conducted for high and low knowledge subjects. "Low knowledge" subjects were those who claimed no knowledge of psychology, and students who indicated that they were familiar with the subject matter were regarded as "high knowledge" subjects.

For this analysis, the lecture was divided into three sections. Actual understanding was then computed for each section in this manner; actual mean understanding for segments 1-8 constituted early understanding; actual mean understanding for lecture segments 9-14, gave middle understanding, and segments 15-23 gave late understanding.

The sections obviously differed in content. The beginning section treated the history of the subject. The variety of questions and issues covered in psychology as a discipline were considered in the middle section, and in the last section, the divisions or areas within the subject. However, the inevitable confounding between content and serial position following from this kind of segmentation could be counter-balanced by taking the number and types of segments in each section into consideration. That is, although content per se could not be matched, the importance (centrality) rating of segments within a section could be used as index of comparability for analysis between sections. Thus comparisons would need to take into account that the first section contained only three central (i.e. important) segments, while the middle and last sections contained one and seven central segments respectively. In addition to the single central segment in the middle section, there were five explicatory segments which were also of high importance (see importance/centrality scale, 7.2.2.1).

7.3.2.1 Familiarity And Words In Notes

The number of words in notes was also regressed on the following predictor variables; age, gender, actual mean understanding, self-rated mean understanding, early, middle and late actual understanding, and number of segments without notes, for the two prior knowledge sub-groups. For **high knowledge** subjects, actual researcher-rated mean understanding (MSU(A)) was the only variable which reached entry criterion in the stepwise regression equation and it accounted for 57% of the variance in the dependent variable, b = .76, F = 28.7, P = .0000. This finding indicates that the degree of understanding influenced not only final comprehension, as already described, but also the number of words used in notes: the better the understanding of the lecture the more notes taken.

Among low knowledge subjects, the degree of understanding for the middle section of the lecture explained 58% of the variance in the number of words in notes, b = .76, F = 19.3, P = .0006. It thus appears that for subjects with no relevant prior knowledge, not all, but some parts of the lecture dictated the volume of notes. It did appear from an examination of means that low

knowledge subjects found the beginning and end sections of the lecture more difficult to understand; something which was also mirrored in the consistently fewer number of words used to record these opening and closing ideas.

7.3.3.2 Familiarity And Overall Comprehension

One regression analysis was performed with overall/final comprehension as the criterion variable, and the same set of predictor variables used in the previous analysis; age, gender, actual mean understanding, self-rated mean understanding, early, middle and late actual understanding, and number of segments without notes.

Regression analysis for high knowledge subjects shows actual mean understanding and number of segments without notes accounting for a combined total of 60% of the variance in overall comprehension, ($b = .53, F = 8.01, P = .01$; $b = .78, F = 15.29, P = .0001$).

Among low knowledge subjects, the results were dissimilar: mean self-rated understanding now explained 61% of the variance in the dependent variables ($b = .78, F = 22.15, P = .0003$). No other variables met criterion for entry in the regression equation. These results indicate that among subjects familiar with lecture material, the researcher's estimate of quality of notes reflected more exactly the level of final comprehension achieved. On the other hand, among students with little relevant knowledge, this externally evaluated quality of notes corresponded poorly with the degree of final comprehension attained, whereas self rated understanding projected it rather well. Essentially, these low knowledge subjects were in a better position than the researcher to know that their within-lecture understanding was not good and it was this that better predicted their overall comprehension.

In summary, among subjects familiar with the subject matter, the record of the lecture, as reflected in the ideas noted (i.e. actual researcher-rated understanding) and those left un-noted was strongly associated with final comprehension. This suggests that the notes were an accurate representation of the

stimulus material. However, among low knowledge subjects, notes taken did not reflect the level of understanding achieved. What was important for overall comprehension was perceived self-rated understanding. It would seem from these results that for students unfamiliar with the material notes represented both the information transmitted in the lecture and their understanding of it poorly. But for both groups of students, the number of words used in the final summary was linked with the degree of understanding reflected in notes. The number of words used in summaries was based on actual (researcher-rated) understanding of the entire lecture among knowledgeable students, but on actual understanding or only the middle section, for students with low relevant knowledge.

7.3.4 Relationship Between Within-Lecture Understanding And Overall Comprehension

In the sections which follow, contingency table analyses are brought into the argument so that the patterning of the numbers and percentages of the various categories of responses, can be understood. Main attention is paid to results which expand the points of argument already made from the correlation and regression analyses.

7.3.4.1 Lecture Phase Understanding

The present analysis retains the division into early, middle and late lecture phases. It will be recalled that the early phase comprised segments 1 - 8, segments 9 - 14 comprised the middle phase, and the final phase segments 15 - 23. Mean understanding achieved for each phase was cross tabulated with overall comprehension and chi square calculated. Subjects who had scored either below or above the mean score for these variables were regarded as low and high respectively on the specific variable.

Consistent with its structural low importance, and its weak showing in the regression analysis, understanding the first phase of the lecture was not significantly related to final comprehension. Table 7.2 shows that the beginning phase was not critical when students with low or high understanding are compared for later high or low overall comprehension. Similar frequency patterns occur in each row and chi square is not significant. Thus high understanding goes similarly with both high or low overall comprehension. For the middle phase, Table 7.3 suggests that some contrast is starting to appear: now high within-lecture understanding does seem to relate to high later comprehension, and chi square is significant. This same pattern is sustained for the final phase of the lecture, Table 7.4.

Table 7.2

Early phase of lecture: Relation between within-lecture understanding and overall comprehension

	Mean Understanding		
Overall Comprehension	Low	High	Total %
Low	9	17	26 (51.0)
High	5	20	25 (49.0)
Total	14 (27.5)	37 (72.5)	51

Chi square = 0.73, df 1, P = .30

Table 7.3

Middle Phase of lecture: Relation between within-lecture understanding and overall comprehension

	Mean Understanding		
Overall Comprehension	Low	High	Total %
Low	8	6	14 (26.9)
High	6	32	38 (73.1)
Total	14(26.9)	38(73.1)	52

Chi square = 6.10, df 1, P = .008

Table 7.4

Final phase of lecture: Relation between within-lecture understanding and overall comprehension

	Mean Understanding		
Overall Comprehension	Low	High	Total %
Low	12	2	14 (26.9)
High	11	27	38 (73.1)
Total	23	29	52

Chi square = 11.1 df, 1 P = .0008

It was pointed out in the preceding section that understanding the beginning phase of the lecture was not critical for final comprehension because it contained information of low thematic importance. This suggests that the importance (centrality) of segments for the lecture need to be taken into consideration in explaining overall comprehension. Accordingly, this factor is incorporated into the next stage of analysis.

7.3.4.2 Segment Centrality And Overall Comprehension

As described earlier, all the lecture segments were indexed using an importance scale for "centrality" of content in relation to the theme of the lecture. Segments identified as central contained very important thematic information, while the labels explicatory, peripheral and redundant indexed information of decreasing thematic importance. The lowest category on the scale, 'distractive/digressive' was not represented in the lecture.

Mean scores for actual understanding were computed not now for phases but for each of the "importance types". These scores were then cross-tabulated with overall comprehension. Notes taken for peripheral and redundant segments were treated as the same type owing to the very small number of subjects who took such notes (see Table 7.5 a, b & c).

Perhaps the most basic expectation for results is that goodness of overall comprehension is going to be associated with high understanding of the most important segments. As Table 7.5(a) shows, none of the 13 students who had high understanding of these segments followed it with low overall comprehension; whereas of the 19 who had low understanding, 7 also had low comprehension. On the other hand, 12 students did not need this high understanding for later good overall comprehension. This weak contrast is surprising and reflected in the just-significant chi square value.

Table 7.5(b) looks at the corresponding data for expository segments. It is understanding here that is crucial. Of the 37 students achieving high understanding of the expository segments, 31 went on to have high overall comprehension. The 15 with low understanding on the other hand, could be either high or low in overall comprehension. The chi square value of 5.7, $p < .01$ underlies this contrast.

Table 7.5

Association between level of final overall comprehension and researcher ratings of understanding of segments

(a) Importance level 5: central segments

Understanding of central segments	Overall Comprehension Low	High	Total %
Low	7	12	19 (59.4)
High	0	13	13 (40.6)
Total (%)	7 (21.9)	25 (78.1)	

Chi square = 4.1, df 1, P = .04

(b) Importance level 4: expository segments

Understanding of explicatory segments	Overall Comprehension Low	High	Total %
Low	8	7	15 (28.8)
High	6	31	37 (71.2)
Total (%)	14(26.9)	38(73.1)	

Chi square = 5.7 df 1, p = .01

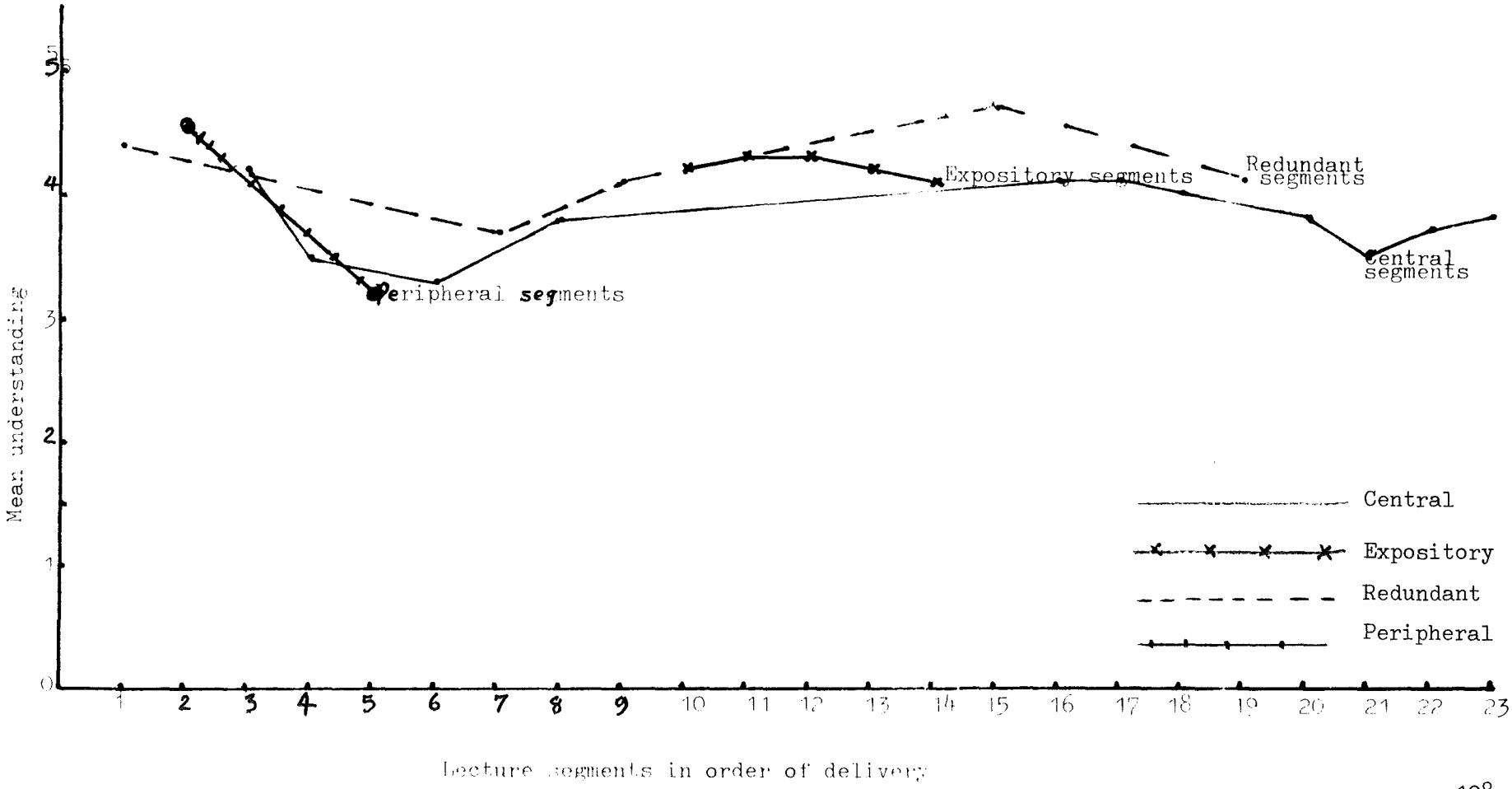
(c) Importance level 3: peripheral and redundant segments

Understanding of peripheral segments	Overall comprehension Low	High	Total
Low	1	1	2
High	1	6	7
Total	2	7	9

Fisher's exact test P = .4

The values in Table 7.5 which were based on the actual notes taken by students secondarily convey the existence of a relationship between understanding segments and noting them. Thus, of the 59 students, 52 took notes on the explicatory segments but only about half this number wrote notes on the central segments (n = 32). Nine of the 59 wrote notes on the peripheral and redundant segments. Only 40% of the students (59%) who took notes on the central segments obtained high mean understanding scores. On the other hand, 71% and 78% of students who took notes on explicatory, peripheral segments respectively had high mean understanding.

FIGURE 7.5 Levels of understanding achieved for lecture segments of different importance



In Figure 7.5 is shown the differences in mean understanding of segments of various kinds across the entire lecture. The graph shows clearly that different levels of understanding were achieved for different types of information. Redundant information was "best understood" while segments containing very important information were consistently the least understood.

7.3.5 Segment Level Analysis

The analysis which follows is at the level of these individual segments rather than groups of segments and further expands the findings regarding importance of segments, level of understanding achieved and overall comprehension.

7.3.5.1 Individual Segment Understanding

It will be recalled that evidence for the understanding of each segment of the lecture was provided by two kinds of data, namely, actual understanding and self-rated understanding. The notes written for each segment were scored by the researcher to provide the score for actual understanding. Students rated their understanding of each successive lecture segment on the 1 - 5 scale identified earlier, to produce a measure of self rated understanding.

Means, standard deviation and modal scores for understanding (self and actual) were computed for each segment of the lecture. Tables 7.6 and 7.7 present these data. The values in Table 7.6 show that the mean scores for researcher ratings ranged from 3.2 to 4.7. The lowest score was obtained for the fifth segment of the lecture which concerned "the physiological basis of psychological practice" and talked about reaction times. The highest mean score was obtained in the fifteenth segment in which the lecturer reiterated what had already been said and talked about and what was coming next.

The modal score for seven segments was 5 and for the remaining sixteen segments, the mode was 4, so that the lecture was generally well understood on the basis of these within-lecture criteria. The range of standard deviations was between .69 and 1.4. Segment 19, which summarized three of the earlier lecture ideas, had the greatest range of apparent understanding as construed by the researcher (s.d. = 1.4).

Table 7.6

RESEARCHER RATINGS OF SEGMENT UNDERSTANDING AS EVIDENCED BY NOTES TAKEN

	SEGMENTS																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Mean Understanding	4.4	4.6	4.2	3.5	3.2	3.3	3.7	3.8	4.1	4.2	4.3	4.3	4.2	4.1	4.7	4.1	4.1	4.0	4.1	3.8	3.5	3.7	3.8
Mode	5	5	4	4	4	4	4	4	5	5	4	5	4	4	5	4	4	4	5	4	4	4	4
Standard Deviation	.79	.69	.86	1.0	1.2	1.2	1.0	1.0	1.2	.96	.69	.88	.87	.88	.89	.67	.74	.75	1.4	.82	1.0	1.0	.84

Table 7.7

SELF RATED SEGMENT UNDERSTANDING

	SEGMENTS																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Mean	4.6	4.5	4.0	3.7	3.9	3.6	3.6	3.9	3.8	4.4	4.3	4.3	4.1	4.2	4.0	4.2	4.3	4.3	3.4	4.0	4.2	4.4	4.3
Mode	5	5	5	4	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
S.D	1.0	1.1	1.2	1.2	1.2	1.3	1.3	1.3	1.4	1.1	1.1	1.2	1.3	1.3	1.5	1.3	1.2	1.2	1.0	1.4	1.2	1.1	1.2

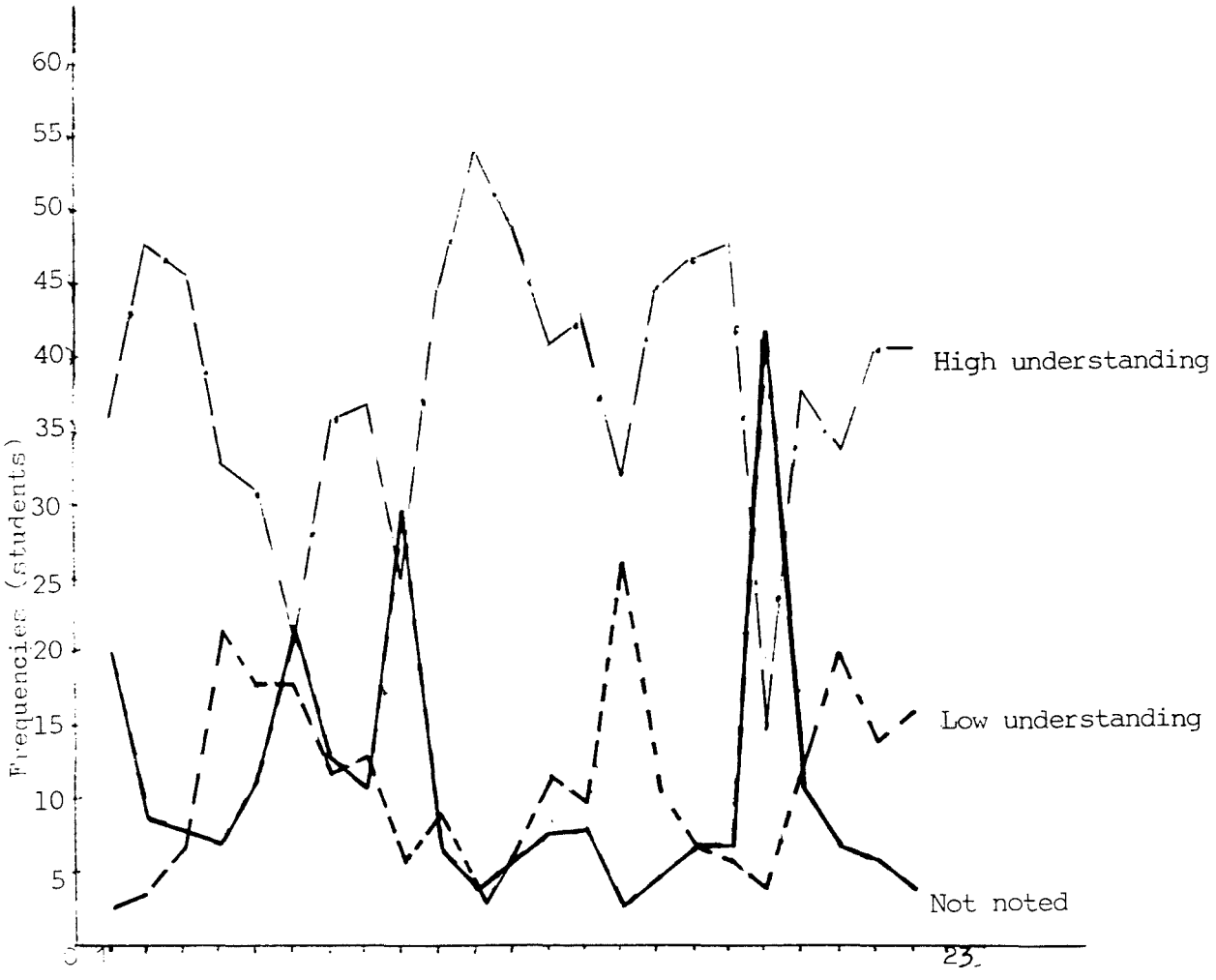
The scores for self-rated segment understanding (Table 7.7) were generally higher than the researcher ratings, clearly highlighting either a more optimistic tendency in the students or a bias to "lowish" ratings on the part of the researcher. These scores are represented graphically in Figures 7.6 and 7.7.

Figures 7.6 and 7.7 which are similar show the frequencies of students who achieved high understanding, low understanding, or took no-notes and gave no self ratings. The profiles for high understanding are the complement of those for low understanding:- as one decreases, the other increases. Clues concerning the nature of processing that accompanied each segment are provided by these figures. It can be seen for example in Figure 7.6 that no-notes was a common response when a segment had low understanding (e.g. segments 1 & 6), or contained information thematically unimportant (e.g. 9, 15, 19). When a segment was well understood (e.g. 3, 7) or important (e.g. 11 & 19), the number of students not recording it decreased. Again, the claimed understanding attained for an idea appears to be related to its importance in the general scheme of things.

The patterns of these graphs seem to qualify usefully the finding made by other researchers that students attend to and note the important ideas in lectures. But surely the ability to a) identify and, b) understand important ideas in a lecture depends to a certain extent on the level of relevant prior knowledge.

Figure 7.6

Researcher-ratings of understanding achieved as reflected in written notes and un-noted segments over the course of the lecture

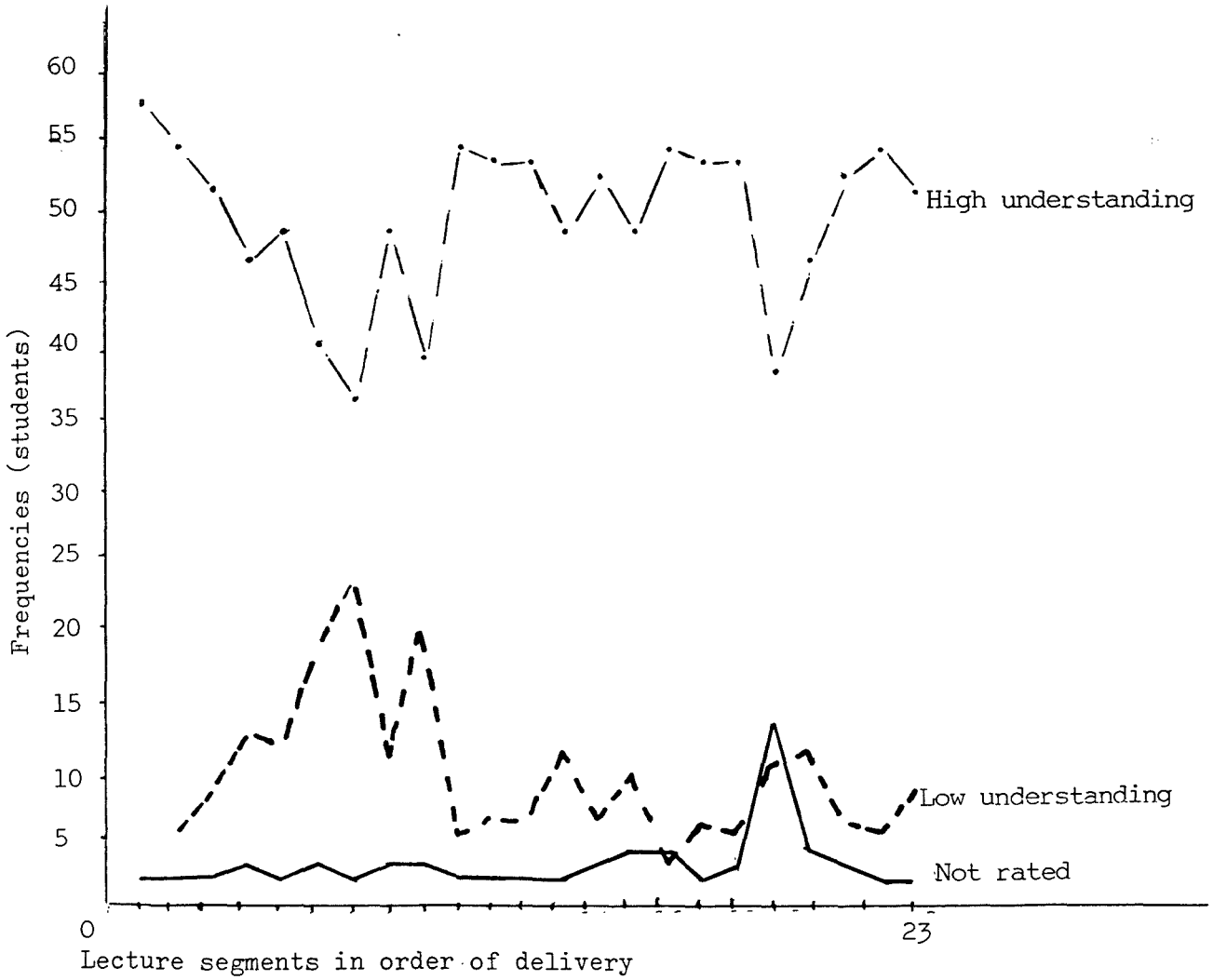


Segments	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Importance	R	P	C	C	P	C	R	C	R	E	E	E	E	E	P	C	C	C	P	C	C	C	C

R = redundant, P = peripheral, E = explicatory, C = central

Figure 7.7

Self-ratings of understanding achieved
over the course of the lecture



Segments	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Importance	R	P	C	C	P	C	R	C	R	E	E	E	E	E	P	C	C	C	P	C	C	C	C

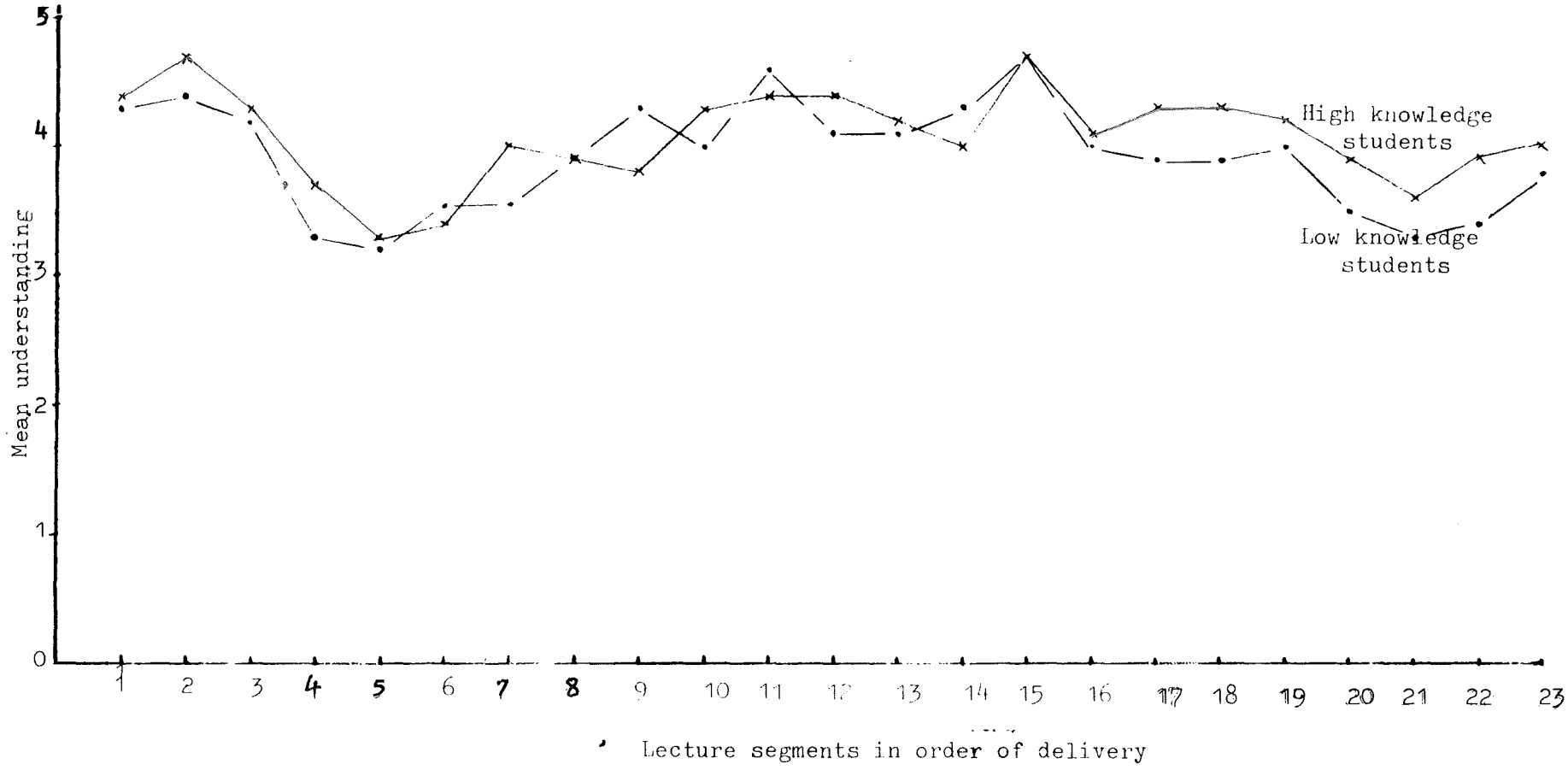
R = redundant, P = peripheral, E = explicatory, C = central

7.3.5.2 Prior Knowledge In Lecture Segment Understanding

As a further stage in the analysis of segment level understanding, we return to this important theme of how prior familiarity with subject matter may or may not help actual understanding of the lecture. Mean scores for researcher-rated understanding for the whole lecture were computed first for students who claimed knowledge of psychology, then for students unfamiliar with the subject.

The results in Figure 7.8 indicate that the general trend for within-lecture understanding in both groups was similar although students with relevant prior knowledge scored slightly higher in seventeen out of the twenty-three lecture segments. Most of these were in the beginning and final phases of the lecture. These results show that students with different amounts of prior knowledge differed in the expected direction though not dramatically or significantly for the level of understanding achieved for the lecture as a whole. This finding is therefore entirely consistent with the implication from both regression and contingency table analyses. This implication is that while prior knowledge level may - and does- influence comprehension, it is only weakly rekated to within-lecture understanding.

Figure 7.8 Mean understanding of lecture segments for students with different levels of prior knowledge



7.3.6 Analysis Of Words In Notes

The present analysis now goes to its maximum level of resolution through quantitative analysis which involved counting all the words in the notes of each segment.

7.3.6.1 Number Of Words In Notes

The total number of words in notes is treated in the present study as a processing and intermediate product variable. Across students, these totals varied greatly, ranging from 32 to 457, (M = 207.7, S.D = 96.4). In order to assess the relationship between extensiveness of notes and overall comprehension, note takers were classified as concise, intermediate and expansive note takers using criteria of 32 - 168, 170 - 236, and 240 - 457 words respectively. (It will be recalled that a similar analysis was undertaken in Study 2 although the methodology there was different).

To make the exercise more concrete to the reader, "expansive", "intermediate" and "concise" styles are illustrated in Table 7.8 which gives one contrasting example of each for the opening eight segments of the lecture. At one extreme, the student whose style of note taking is labelled as expansive (student C), used sixty words to represent the ideas in two segments of the lecture employing a total of 457 words for the whole lecture. Student B used about the same number of words (47) to represent ideas in but three of the lecture segments and recorded a total of 378 words in her notes, whereas at the other extreme, student A (male) used forty-nine words to record all the idea units contained in the whole lecture! The actual words delivered by the lecturer for these segments can be seen in Appendix 7.1.

TABLE 7.8 Examples of Concise, Intermediate and Expansive Notes

	NOTES		
Segment	Concise (A)	Intermediate (B)	Expansive (C)
1	'Definition	-	'Psychology is: Why they do things Intelligence thinking
2	History	Psychology's History 17th Century starting point	Discipline of psychology has a history Greeks and beyond
3	Origin	Eng Philosophy - 1650-1750 they believed mind made up of all ideas in head	17th century English philosophers. They asked what is mind? What is mental life? Ans: Things coming from outside making an impression outside world writers itself on our brain cells. All information in head is from the outside. (Experience is key to understanding)
4	Early concepts	C18th + C19th - Wundt represents joining of dimensions of minds	Mind can be broken up into elementary ideas 18th - 19th century. Wundt 1875 represents coming together of 2 influences Philosophy analysize the mind
5	Nerves	Nature of nervous functions, electrical pulses = 19th C.	18th century time of discovery. Nervous transmission. Out of this ear - Helmhozt - teacher of Wundt arose.

Table 7.8 Cont'd

6	Reaction times	-	In Wundt fusion of philosophical question tackled by reaction time, elements of vision + hearing - gazing more deeply
7	N. American Psychology	USA 1900-1950 - most influential of all psychology. Breaking down behind into parts	USA 19th Century - N. American Psychology most influential line of influence follows to modern day - Observable analyzable conscious life
8	Moods	Freud (1900) - his contribution was about the unconscious + dreams. He believed psychology of unconscious life more important Past might have effect on your future'	Freud contrast 1900 contributed - more interesting UNCONSCIOUS life. There are reasons for things which are not understandable may be in upbringing. Large part of total mental life lies outside immediate access. DREAMS Depression indication of this.'

Table 7.9 shows that this noting style was in fact unrelated to overall comprehension. This finding is consistent with the earlier regression modelling which similarly found no relationship between number of words in notes (WN) and overall comprehension (OC) - see Figures 7.3 and 7.4.

Table 7.9

Number of words in notes related to overall comprehension

	Notetaking style		
Overall Comprehension	Concise	Intermediate	Expansive
Low	7	4	3
High	12	13	15
Total(%)	19 (35.2)	17 (31.5)	18 (33.3)

Chi square = 2.0 p = 1 df,2

Although in previous studies the number of words in notes has commonly been found to be positively related to recall, this result must nonetheless point to the equivocal nature of such a claim.

Though the total number of words used in notes was unrelated to overall comprehension, the number of words by segment was revealing, especially when set against the thematic importance (centrality) of the the segment as can be seen in Table 7.10. The values in the table show that more words were used as segments increased in importance.

Table 7.10

Words in Segments in relation to Content Thematic Centrality

Segment 1 - 23

Segment Centrality	2	3	5	5	3	5	2	5	2	4	4	4	4	4	2	5	5	5	2	5	5	5	5
Mean	5.0	6.2	15.7	9.9	5.9	5.0	6.9	15.8	3.9	10.9	10.0	12.4	6.2	11.1	2.7	7.1	13.1	11.8	1.3	9.7	11.8	8.8	8.2
Standard Deviation	6.3	4.6	9.2	6.1	4.6	5.1	4.6	10.4	4.7	7.9	6.8	7.6	6.1	7.8	2.9	4.4	7.7	7.1	2.8	7.2	6.7	4.9	3.7
Maximum	32	16	33	23	15	16	17	37	16	35	37	35	24	29	13	16	32	28	10	25	26	21	16

Centrality Scale: 5 = Central
4 = Explicatory
3 = Peripheral
2 = Redundant
1 = Distractive/digressive

Essentially the same information is presented in Table 7.11 but in sharper focus.

Table 7.11

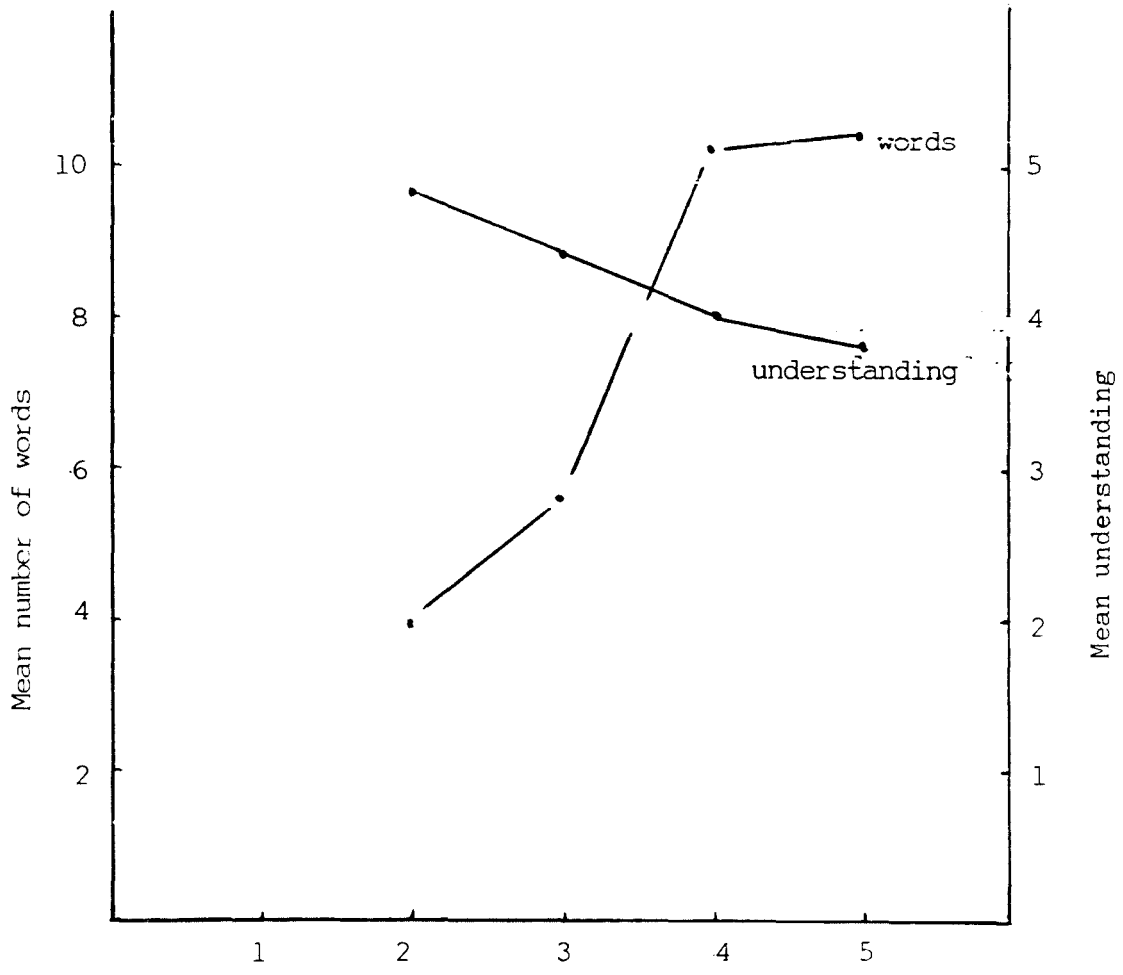
Number of words by importance of lecture segments

	Segment Importance			
	Central	Explicatory	Peripheral	Redundant
Mean Words	10.7	10.2	5.3	3.9
Standard deviation	4.7	5.7	2.9	2.3
Mode	11.6	5.4	4.0	3.0
Maximum (Range)	21.8(20)	30.2(28.2)	12.0(12)	10.0(10)

Figure 7.9 is useful in bringing together two strands of the foregoing results,from which it can be seen that, as the importance of segments increases, (i) more words are used to record notes, and (ii) mean understanding decreases.

Figure 7.9

Interaction between segment centrality, mean number of words in notes, and mean understanding



It is, however, not clear from Figure 7.9 whether importance or understanding may be the generator of lengthier notes.

Accordingly, representative segments which contrasted these two dimensions were examined for a random sample of subjects and the results are shown in Table 7.12.

Table 7.12

Interaction of understanding, segment importance and number of words

Segment	Importance	Understanding	Mean words
18	High	High	11.8
6	High	Low	5.0
2	Low	High	6.2
19	Low	Low	1.3

These results indicate that what is important is the interaction between importance and understanding achieved. Neither high understanding nor high importance **alone** sufficed to push up word totals. A combination of high importance and high understanding resulted in a doubling of the number of words used.

7.3.6.2 Number Of Words In Notes By Gender

In a couple of studies (e.g. Hartley & Cameron, 1967; Maddox & Hoole, 1975)

in which gender differences have been reported, as in the present study, women were found to take more notes than men. Results from the present study agree and show that there were twice as many male concise note takers as female. This gender ratio was reversed for expansive notes. Table 7.13 shows the complete pattern. This difference in notetaking style was found to be significant. This result is consistent with known gender differences in verbal fluency. Although there is no great theoretical interest in gender differences in the present research, such similarities with the existing literature do provide a welcome validation of sampling and procedure.

Table 7.13

Number of words in notes by gender

	Note Volume		
Gender	Concise	Intermediate	Expansive
Female	7	12	13
Male	15	7	7
Total %	22(36.1)	19(31.1)	20(32.8)

Chi square = 5.8 df 2 p = .05

7.3.7 Number Of Words In Summary

The final step for the results of Study 3 is to examine any relationship between the two parallel outcome variables namely, length of summary and overall comprehension. Previously, the two variables were seen as parallel estimates

rather than as having any causal link (see Figure 7.3) and the results given in Table 7.14 are consistent with this conceptualization.

The total number of words used in the summaries ranged from 9 to 147 (Mean = 65.3, S.D. = 37.8, Mode = 69). In order for the relationship with overall comprehension to be assessed, the summaries were classified as short(n = 14), medium(n = 19) or long(n = 21) according to intervals of 9-30, 31-69, and 70-147 words respectively. There is a slight tendency for high comprehenders to have longer summaries and for the low comprehenders to have medium to short summaries. However, the trend contrast is not significant; chi square = 2.49; p = .2 (see Table 7.14).

Table 7.14

Length of summary and overall comprehension

	Summary length		
Overall Comprehension	Short	Medium	Long
Low	5	6	3
High	9	13	18
Total	14(25.9)	19(35.2)	21(38.9)

Chi square = 2.4 df 2 p = .2.

It will be recalled from section 7.3.2.2 that multiple regression analysis had indicated that the number of words in notes (WN) together with the number of segments with zero notes (SZN) were the only significant predictors of the number of words in summary, (b = .42 and .29 respectively). This present result further confirms that the number of words used in the recall was not directly re-

lated to either within-lecture understanding or overall final comprehension.

7.4 SUMMARY OF FINDINGS

The findings of the present study have been:

A: Influence of prior knowledge (self and researcher-rated)

1. Generally, prior knowledge does not influence in-situ processing (understanding) of lecture information, but self-rated prior knowledge positively influences the comprehension outcome.

2. For knowledgeable subjects, researcher-rated prior knowledge predicted final comprehension.

3. Self-rated prior knowledge predicted final comprehension for subjects unfamiliar with lecture material.

B: The significance of actual (researcher-rated) within-lecture understanding

1. Mean understanding of the individual segments of the lecture had the strongest causal link with comprehension.

2. Understanding the important segments of the lecture was positively related to overall comprehension.

3. The greater the number of important segments understood, the better the overall comprehension.

4. Understanding the peripheral and redundant segments was unrelated to overall comprehension.

5. Overall mean understanding decreased as lecture segments increased in importance.

C: Number of words in notes and recall

1. Gender was related to extensiveness: females tending to use more words.

2. Number of words in notes was related firstly, to understanding attained for the specific idea and then to its importance.

3. Mean number of words used in notes increased as segments increased in importance.

4. The number of words used in notes was positively related to the number of words used in recall.

5. Number of words used at recall was unrelated to comprehension.

6. The number of words in recall was influenced by the number of words in notes together with the number of segments without notes.

D: Content status (i.e. importance) and notetaking

1. Ideas were not noted when they were perceived as unimportant.

2. Very few students noted peripheral or redundant ideas although

these were the best understood.

3. Fewer students recorded notes on the most important (i.e. central), than on explicatory segments (see also B4).

4. Expository segments were better understood than central segments.

7.5 DISCUSSION

Very few previous studies have considered prior knowledge worthy of investigation in a notetaking context (Peper & Mayer, 1978, 1986). This is perhaps strange, as it would seem a likely candidate for modulating within lecture understanding and notetaking. Schema theorists (Ausubel, 1968; Rumelhart & Ortony, 1977; Anderson, 1984; Schallert, 1982) and generative theorists (Wittrock, 1974) go further and see extent of background knowledge as the determinant of whether useful learning will take place.

The picture in respect of prior knowledge in the present study is interesting. It suggests that prior knowledge although important in determining eventual outcome is not evidently a determinant of within-lecture processes or of the activity of notetaking in particular. Of course, processing is a time related variable (cf. Hunt, 1973; and Hunt & Lunneborg, 1975) and in a lecture, unlimited time is not sufficiently available. It is therefore suspected that the benefits of prior knowledge may not be available to be mobilized and brought to bear on a rapid processing task which may itself involve substantial search in long-term memory.

What is being suggested is that deep processing in the sense used by Marton and Saljo (1976 a&b) and Entwistle et al. (1977), among others, may well have minimal relevance to within-lecture understanding, particularly for students with little prior knowledge or language competence. Another possibility in the

present context is that although low and high knowledge students were compared, the true acquaintance of even the present notional high knowledge students may have been so low as still to be "off-scale". If this were the case then Ausubel's claim for the hegemony of prior knowledge would not be threatened and the link with processing strategy in the present study is explicable.

On the other hand, the period after the lecture during which the summary was being written could afford the students time to tap relevant prior knowledge and connect it with the presented information, thereby allowing prior knowledge to account for a significant percentage of the variance in the outcome variable but at the same time not in the processing variables.

Equally interesting are the results in respect of the understanding of the time-related lecture sections (segments). The mean understanding (of all twenty-three segments of the lecture) alone accounted for nearly half of the variance in overall comprehension. It is a result which is significant because commonly in notetaking studies, understanding is not usually differentiated from recall where there has been a tacit equation of noting ideas with understanding them. This study clearly points to a difference between the two. But the more detailed findings reveal a close and complex relationship between understanding ideas and the notes produced to represent them. That an idea is recorded is not evidence of it having been understood, but the note does reflect to a certain extent the degree of understanding achieved for the specific idea. It is this relationship between the note, the understanding it represents and the eventual comprehension which is significant for eventual performance.

Of course, "Number of words" is a commonly used variable in notetaking research and has led to arguments both in favour and against extensive notetaking. Two indices, one of efficiency and the other of completeness of notes, reflect these opposing views. Howe (1970) proposed the efficiency index, arguing that efficient notes are those in which the fewest possible number of words are used to record the idea. Locke (1977), Anderson & Armbruster (1986) and more persistently, Kiewra (1986, 1988), believe that more notes are better. The data from the present study suggest that it is not the number of words per se

that relates to final comprehension, but the interaction between segment importance and understanding achieved. Thus it was observed that the number of words increased as segment importance increased and understanding decreased (see Figure 7.9). Taken simply this result might suggest that more words reflect poorer comprehension. But of course other characteristics in the message may interfere with what is recorded in notes. For example segment length, information density and speed of presentation are important as Aiken, Thomas and Shennum (1975) point out. It seems justifiable to interpret the present result as longer notes signalling either the student's due recognition of importance or merely a pedalling to keep up with an idea flow being understood only dimly. Long notes could therefore signify simple recognition of importance in students with high prior knowledge and anxiety-based motivation in students with low prior knowledge.

How does one know when a long (or a short!) note calls for the one and not the other interpretation? This dilemma points to the danger of depending solely or even largely on a measure of the number of words in making declarative judgements about recall or performance. The results of the present study suggest that a clearer picture can be obtained when the number of written words is set against information on both importance and understanding of the segment. Results of the relationship between expository segments and overall comprehension provide a good example of this relationship. As seen earlier, understanding these segments was more important for final comprehension, the possible reason for this being that, high importance was coupled with high understanding.

This relationship can be summed up by the following conditional statements:

1. If the understanding of the segment (information) is high and the perceived importance is high, the mean number of words in notes will also be relatively high.

2. If the understanding of a given segment is low, and perceived importance is also low, then notes will be minimal.

3. If the understanding is high for a segment of low, importance the mean number of words will be intermediate.

4. If the understanding is low for a segment perceived to be important, the mean number of words will also be intermediate.

As far as is known, no earlier study has looked closely at what non-notetaking represents. Zero-Notetaking can be a signal of two possible conditions; (i) information of little perceived importance, and (ii) possibly poor actual understanding. In four of the five segments (1, 9, 15, 19) where one-third or more of the sample took no notes the information was unimportant. It is tempting to infer that a judgement concerning the low note desirability of these particular segments had been made.

Conversely, we suggest that when for some segment of perceived high importance a high frequency of "No Notes" is encountered, this indicates that poor understanding is implicated. It could be counter argued that perhaps the right judgement concerning the status of the particular segment had not been made. But Anderson & Armbruster (1986) along with Hartley & Cameron (1967) argue that students usually do attend to and note what they perceive as important ideas in a lecture. The results of the present study are consistent with this view.

Alternatively, each idea unit in the lecture could be seen as representing a decision choice point The safest most conservative rule would then be to write everything down verbatim. However, this entails high cost in terms of attentional and writing effort. Lower cost alternatives include noting sample phrases or even just key words here and there. It would be interesting to know how high and low prior knowledge subjects use such decision rules as 'minimax' or satisficing in notetaking.

The general implication of these findings for teaching is that notes can be used for diagnostic purposes and consequently intervention, because they offer signals concerning occasions when help may be needed with the processing of

learning materials. Recently notetaking studies have involved the training of different notetaking strategies with little success, (Jonassen, 1984, Kiewra & Fletcher, 1984). This study implies that the more effective strategies for notetaking per se would be those that seek to improve real time understanding of the to-be-noted material within the lecture more than those aimed at building up prior knowledge. This could be a useful direction for future notetaking studies.

CHAPTER 8

CONCLUSIONS

CHAPTER OUTLINE

8.1 Introduction

8.2 Originating questions for the studies

8.3 A cognitive model of notetaking

8.4 Conclusions and recommendations

8.1 INTRODUCTION

In this chapter an evaluation of all three studies reported in the thesis is undertaken and the extent to which the questions posed in Chapter 3 have been answered is examined. Finally, a cognitive model of notetaking activity based on the findings and their implications is offered.

8.2 THE ORIGINATING QUESTIONS FOR THE RESEARCH

The questions posed in Chapter 3 which the studies were set up to investigate were:

1. How is lecture material processed for notetaking?
   In particular are levels of processing discernible?

2. How is processing reflected in notes?

3. Is comprehension relatable to measurable attributes of notes?

4. Will the influence of prior knowledge be evident in the
   noting and comprehension of ideas transmitted in a lecture?

5. Do age and gender of subjects influence their noting
   and comprehension of lecture material?

6. Can intervention be planned so as to improve notetaking skill?

Two theoretical positions informed the questions raised above. The first and second questions were posed within an information processing framework and therefore emphasized identification of processes. Three of the questions (3, 4 and 6) were set in the framework of the generative hypothesis which draws heavily on schema theory, highlighting prior knowledge and comprehension. Question no. 5 is evidently psychobiological. We now treat these questions i.e.

the answers provided from the studies reported so far in turn:

1. Evidence of Levels of Processing From Recorded Notes

The "post-lecture" diagnosis results from Study 2 point to an inference that notetaking processes are not only important but are deployed by different groups of students with different degrees of effectiveness. It will be recalled the data were analysed by recourse to a four-stage levels of processing model based on hypothesized speed of execution and sequence of instantiation. An example of a process identified as shallow was paying attention to meaning with the intention to understand the message in the transmitted information. Deeper processes involved integrating personal/world knowledge with lecture ideas. The emphasis in the levels of processing approach given to relating prior knowledge to presented information in the construction of meaning (cf. Marton & Saljo, 1976) is not shared in the model to be proposed here where the notion of levels is time related. Underlying the model is a notion of the varying configurations among processes leading to different products i.e. notes. The differences observed among different subgroups of the sample do provide evidence for this. The results imply that among subjects who were either unfamiliar with the lecture material or below average in language ability, a high degree of co-activation of shallow processes was common - and perhaps appropriate in the sense of being effective within the specific problem situation. Dealing with meaning seems to be a function not so much of prior knowledge or language ability as of a within-lecture strategy of transforming ideas or integrating them with relevant background knowledge. For subjects with little background knowledge, scaling ideas within a lecture can be achieved on within-lecture cues. Alternatively, writing down just about everything the lecturer says, another second level process, can be activated to compensate for scaling deficiency in the absence or non-usability of cues in the body of the message.

The foregoing points imply that students with knowledge of the subject matter and above average language ability should show extensive co-deployment of

deeper processes. Indeed, data from Study 2 indicate that integrative notetaking processes were related to final comprehension **only** for students who claimed knowledge of psychology. This finding is important because it implies that for students without reasonable prior knowledge, instantiation of deeper processes is at best unrelated and at worst negatively related to the extensiveness of information noted. For these students, it was shown that note volume itself rather than integrative processes was positively related to final comprehension.

The proposal that deeper processing can be counter productive for note volume seems to suggest that deeper processing is unnecessary, and inappropriate for notetaking. However two points must be borne in mind. The first is that this rule would not apply when familiar material is encountered. So, the data suggest in answer to question 1 that processing for notetaking is accomplished by processes which occur in a sequence of increasing depths, the deployment of which is itself influenced by such factors as language ability and more significantly familiarity with the subject matter. Second the direction of the relationship cannot be specified: could it be that extended notetaking is inhibitory to deeper processing? This is discussed in Chapter 6 (6.4.5.3).

2. How is Processing Reflected In Notes?

The question of whether levels of processing are reflected in actual notes taken at lectures is a crucial one for notetaking research. The approach through levels of processing is currently considered promising and studies which have investigated notetaking within this framework include those by Bretzing & Kulhavy, 1979; Rickards & Friedman, 1978; Shimmerlick & Nolan 1976; Fisher & Harris, 1974; Howe, 1970; & McClendon 1958, Kiewra & Fletcher, 1984; Jonassen, 1984. However these studies have not led to any clear indications.

A criticism levelled against most of these studies is that examination of actual notes taken in real classrooms is not undertaken. Another possible reason for absence of clarity may be the premature pre-occupation with linking activities

presumed to be at different levels of notetaking processing with recall. The aim in studies has been neither to adduce evidence for a level of processing model specifically, nor the identification of notetaking processes to verify whether they can be so conceptualized. The emphasis has been rather to show the type of processing most likely to influence recall. As just remarked, results are not clear. Results from the present study support the argument that notetaking activity is a self-contained system of interrelated input, processing and output operations. Within the processing subsystem, operations can be ordered to reflect a not-necessarily-linear sequence. Review and recall are best seen as external and distinct from, but capable of freely interacting with the notetaking system as such.

The most useful thoughts concerning the notetaking system ought to arise from addressing it systemically, as has been undertaken here in Study 3. With respect to levels of notetaking, Kiewra and Fletcher (1984) aver that students' notes generally reveal the same shallow verbatim restatement or simple paraphrase of information regardless of either instructions or actually intended deeper processing. Although this view is questioned by the results of the self-report study (Study 2), the design of Study 3 was perhaps better suited to test its veracity. Study 3 generates data which suggest a more complex view of the activity, involving processes at various different levels.

Evidence to demonstrate processes at the attentional level of the model was difficult to uncover. This was due to the nature of the process itself which was more a statement of intention than evidence of such action. However, this particular process can be presumed to have been instantiated because of the extensiveness of notetaking, signifying that attentional resources of some kind had been utilized.

Students' notes also provided evidence of processing at the other levels proposed in the model. Evidence in support of a scaling level which involved identifying the relative importance of lecture ideas is available. Thus ideas which were redundant in the lecture were generally not noted whereas correspondingly more words were used to record the more important ideas.

Previous studies that show that low ability students and subjects with knowledge of the subject matter record different kinds of propositions also provide indirect support for scaling. When the results of such studies are interpreted not in terms of student type, but on the basis of what is noted, scaling differences become clearly identifiable. Peper & Mayer (1978) and Einstein et al. (1985) for instance, reported that more propositions of higher importance were written by subjects who were either familiar with lecture material, or "more successful".

Transformation was also evident in student notes. Two kinds of transformations were identified. First, the limiting case, omissions were widespread. It can be argued that omissions could occur by default, i.e. when students did not pick up ideas through inattention. However, there was evidence to suggest that omissions were deliberate, being based on information and decisions regarding the importance and note desirability of lecture ideas. For example in Study 3, one segment (segment 15) which contained redundant information and was claimed to be very well understood was in fact very minimally noted.

The second kind of transformation in great evidence was reproductions, where students recorded lecture ideas usually through the use of paraphrase or word-for-word representation. More sophisticated (deeper) processing according to the model discussed in Chapter 6 is represented by integrative processing where words and ideas from the individual's own repertoire were used. Although the available evidence was slim, instances were nevertheless found to support the claim of its existence.

The question raised earlier concerned the extent to which notes are indicative of deep or shallow processing. There does not seem to be enough evidence to uphold the statement by Kiewra & Fletcher (1984) that " [all] notes reveal the same shallow verbatim restatement or simple paraphrase". Though there is some evidence from Study 2 to suggest that among students with little background knowledge or low language ability, processing involves a high activation of processes at shallow levels, this situation is not applicable either to knowledgeable subjects or to concise note takers.
The absence of a framework akin to the levels of processing model proposed in

Chapter 6, and within which notes can be analysed, may well be the reason behind Kiewra & Fletcher's blanket observation. This same absence could be the reason behind the opinion that students' notes are brief and of questionable value (cf. Kiewra, 1985b). Brevity in student notes, the limiting case of which is no notes for a given idea, can be explained quite convincingly within the model proposed. The peculiarities of the problem of space in the task of notetaking demand brevity. Moreover quality does not covary with quantity. To suggest therefore that brevity is ineffective is to show a certain lack of understanding of the processing demands of the task and/or the processing differences among different types of students.

The judgement that notes are of questionable value is difficult to defend, explain or admit on two grounds. First, notetaking at lectures is still, an extensive practice among students. Although this in itself cannot be adduced as evidence for usefulness, results reported by studies which show that students who use personal notes perform best, reaffirm the significance of notetaking (Carter & Van Matre, 1975, Rickards & Friedman, 1978; Annis & Davis, 1975). These studies along with the present study provide support for the existence of an enhancing relationship between aspects of notes recorded at lectures, and performance on an outcome variable, commonly recall or comprehension. Very few studies have actually found notetaking to be dysfunctional (Peters, 1972, Ash & Carlton, 1953), and the findings of no significant difference in a fair number of notetaking studies are at least partly attributable to methodological deficiencies as outlined earlier in Chapters 2 and 3.

3. Is Comprehension Relatable to Measurable Aspects of Notes?

Results from Study 3 affirm that not only were recorded notes related to performance on an outcome variable, but within-lecture understanding was also mirrored in notes. The degree of understanding achieved influenced both the number of words and final comprehension. By implication, understanding is at the heart of notetaking. This study and the model to be proposed offer tenta-

tive explanations for such a relationship and this aspect will surely benefit from more research.

4. Influence of Prior Knowledge

The influence of prior knowledge, neglected in most of the research on notetaking activity, has been shown with consistency in Studies 2 and 3 to be crucial. It is argued by schema theorists that background knowledge is central in performance. Results from studies 2 and 3 support this view, highlighting how different levels of prior knowledge are associated with distinct processing differences which become manifest in performance.

It was found in Study 3 that prior knowledge was unrelated to segment-by-segment understanding in the ongoing lecture. However, as this understanding is passed into long term-memory, deficient schemata may prove inadequate to capture the processed information, hence prior knowledge is a factor in comprehension. Clearly a difference is being claimed between understanding and comprehension. In particular, it is the relationship of understanding with prior knowledge that deserves further examination.

5. Age and Gender in Notetaking Activity

Although age and gender were found not to actively influence comprehension, the gender factor was operative in notetaking processes, in particular, in transformations deployed; males tending to use more omissions and females more reproductions showing up in notes as fewer or more words respectively. Placing this information alongside known gender differences in verbal ability, it can be suggested that females in the sample found it unnecessary to transform words as these may largely already be found in their repertoires. By reversed logic therefore, male subjects may have had a greater need to transform lecturer words on

account of their "lesser" verbal ability. Of course it may not be this simple.

6. Can Notetaking Skills Be Trained?

The last question concerned whether notetaking activity could be improved through training in the use of specific strategies, in this instance, summarization and networking. The underlying assumption here is that the key to notetaking effectiveness lies in the processing components of the activity. Summarization and networking are thus process oriented actions or strategies. Against this, it could be argued that the more important aspects of the activity of notetaking do not reside in the process factors but within the prior structures, cognitive or affective, which an individual brings into the task situation. An intervention programme predicated on this latter assumption would emphasize the input structures for example improvement or training in relevant knowledge or affective factors such as interest and motivation. While this would not be contested, it must be remembered that very positive evidence has been produced here for the importance of within-lecture understanding. It is surely the role of techniques such as summarizing and networking to optimize the bridging process between that understanding and the waiting schemata.

Data from Study 1 (reported in Chapter 5) revealed that although training in summarization did lead to changes in students declared notetaking skill, performance on an end-of-term test was not significantly better for the trained groups. This result is not unusual for notetaking training studies (Corey, 1935a; Palmatier, 1968; Palmatier & McNinch, 1972; Bizinkaukas,1970). Although the absence of differences suggests that the more important aspects of notetaking may not have been activated in these studies, results from Studies 2 and 3 (Chapters 6 & 7) do not support this position. Nevertheless it is very difficult to argue the null case, and given the limitations of the present Study 1, the question ought to remain open.

In conclusion, the results of all three studies suggest that explanation of

notetaking activity can be handled within two theoretical positions: information processing and the generative principle. While the view was expressed in Chapter 3 that the generative model appeared to offer the more appropriate conceptual framework, our results signified that the activity could not be explained solely from a generative view point. Information processing concepts need to be incorporated. The generative perspective emphasizes prior knowledge and understanding in learning, factors which have been clearly shown in the present investigations to influence notetaking activity. The actual manner of this influence is explained in terms of process instantiation and the activity itself which together constitute the strategy. This processing strategy can then be elucidated by a modified information processing theory. Our results show that when students are differentiated on grounds of relevant prior knowledge they use different notetaking strategies. The kinds of processes deployed indicate that the manner in which relevant prior knowledge is brought into the task environment is different for different subjects, and this is reflected in the types of notes produced. The levels represented in the processing model advanced in Chapter 6 are sequential, but processes within given levels can be simultaneously instantiated.

It is opportune at this juncture to offer an encompassing model of notetaking activity informed by the results of the three studies.

8.3 A COGNITIVE MODEL OF NOTETAKING

Figures 8.1 and 8.2 may be considered together. Figure 8.1 is a more or less structural representation of the several classes of variables that need to be recognized in a comprehensive cognitive model of notetaking. Figure 8.2 then, as it were, looks inside the box in Figure 8.1 labelled in-lecture processing, and which of course has been the primary focus of this thesis.

Figure 8.1 is therefore a macro model of the notetaking system. It consists of subject processing and intermediate product variables which are interrelated in

the way the diagram shows. The subject variables could be cognitive, for example background knowledge, language or general ability, or affective, for example dis/interest in speaker or topic (see later comments on affective variables). Such input factors both influence and are influenced by other lecture input and within lecture processing variables. These latter share a similar two-way relationship with the processing product (notes). The quantity and quality of notes is itself influenced by input factors together with subject variables. Thus, what is noted at one point, becomes input for the processing of newer information at a later time. As can be seen, the model implies that comprehension outcome variables do not constitute an integral part of the notetaking system. Essentially therefore, this macro model emphasizes the non seriality and the mutual interrogation among variables which gives rise to notes and eventually comprehension.

As indicated, Figure 8.2 unpacks the processes inside the box labelled in-lecture processing in Figure 8.1. The operator labels used in both Figures 8.1 and 8.2 are the same as the variable names in Studies 2 & 3. The filter operator in the first "diamond" is affective: "Are you interested in the message". This may lead to contrasting reactions in terms of notetaking behaviour, manifested as either inhibition or facilitation of processing. Inhibition exits directly to cessation of processing (i.e. sporadic or no attention with no notes or doodling). In contrast, the Yes gate leads to a second filter: "Do you have relevant prior knowledge?" The Yes or No split at this operation determines whether appropriate schemata will be readily available to influence final understanding achieved. The point here is that schemata will not directly improve segment (idea) understanding per se but will provide a framework for efficient reconstruction/resynthesis at comprehension.

Further processing activities are represented by the three diamonds which follow: understanding the point; ranking its importance, and recording it selectively. They mark decision nodes which eventually lead to different products, namely, concise or expansive notes, as shown in Figure 8.2.

Figure 8.1

Notetaking system

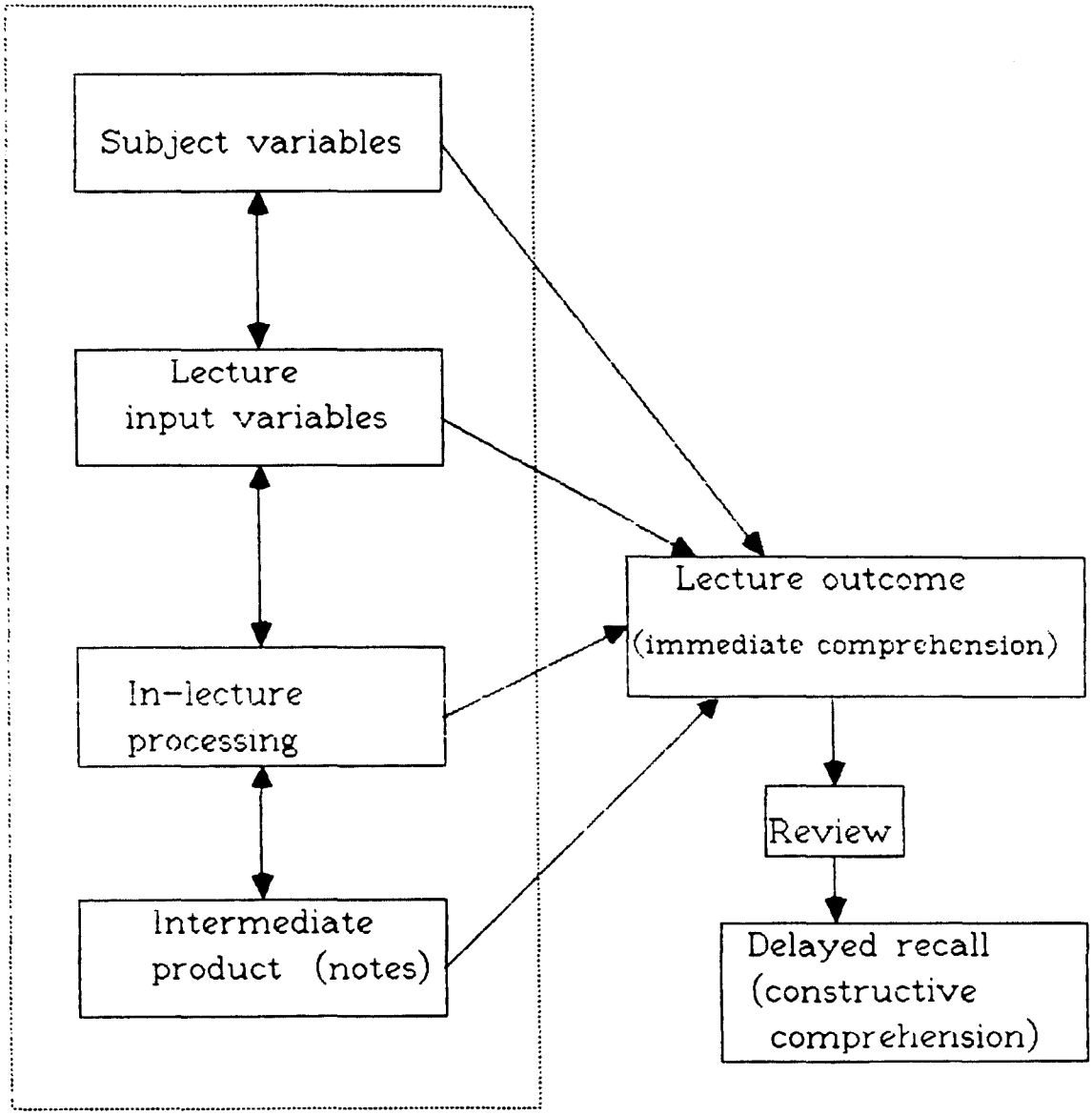
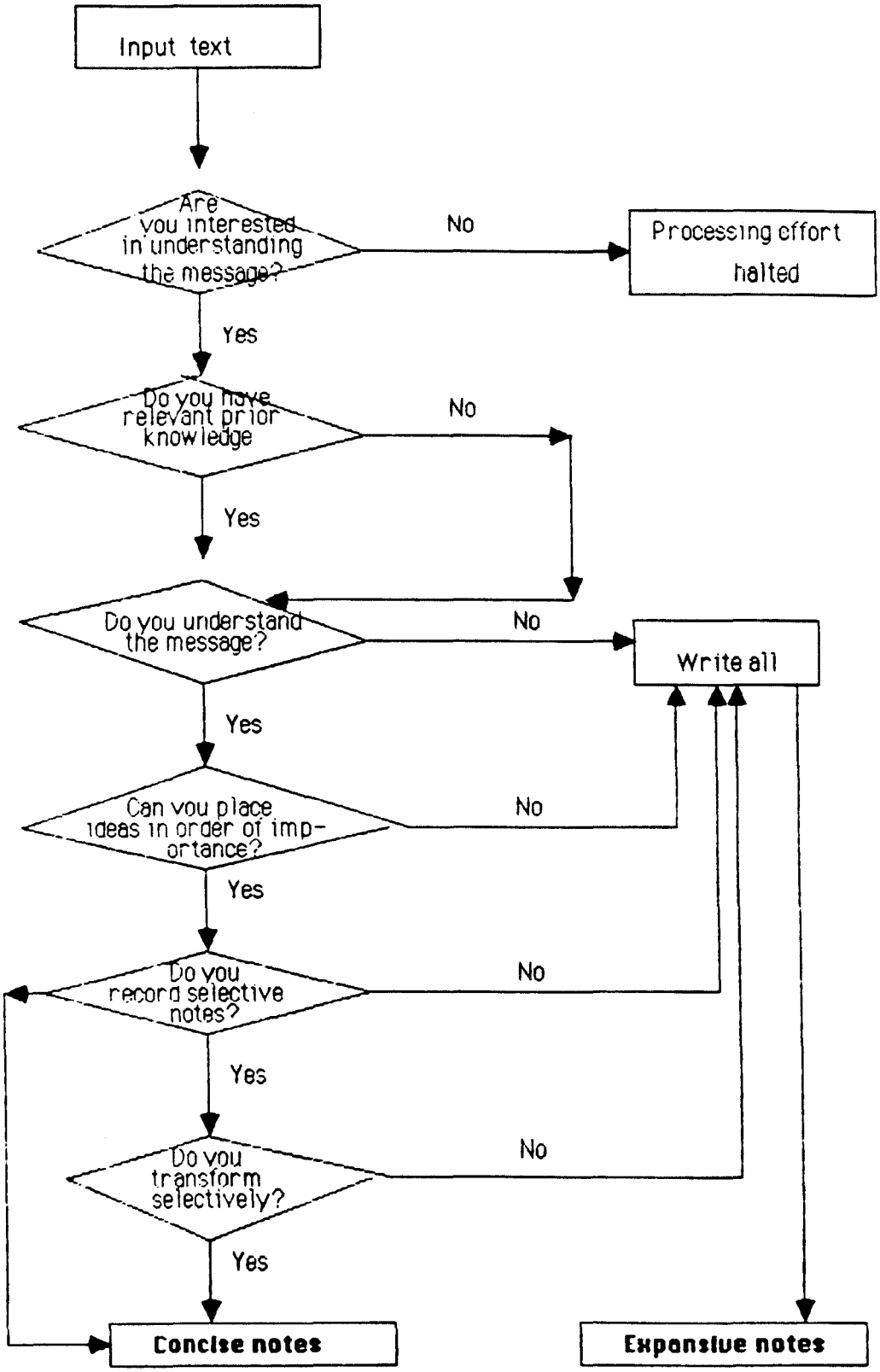


Figure 8.2

Model for processing information for notetaking



The amount of notes recorded i.e. note volume is conceptualized as being inversely proportional to: (i) the amount of processing deployed, because more processing involves higher levels of activation for critical, time and capacity consuming processes such as Attention, Scaling, Selective Writing and Integrating; (ii) the amount of background/prior relevant knowledge, with an increase in either one of these being accompanied by a corresponding decrease in note volume.

On the other hand, note volume is considered to be directly proportional to the intention to learn or pick up information from the stimulus lecture or text. Thus the quantity of notes recorded increases as the intention to learn from the lecture heightens, but bucking against this, the quantity of notes produced decreases as more intensive processing is engaged and/or when subjects have rich domain specific knowledge of the subject matter. There are of course other factors which influence note volume, but these are not within the learner's cognitive apparatus. The models depicted in Figures 8.1 and 8.2 would seem to capture the major cognitive operations and offer an advance over models that have so far been proposed.

The proposed models imply that notetaking activity can be described within the framework of a system which is self-equilibrating. Input variables, both cognitive and affective, influence process instantiation and explain the characteristic type of notes produced. These notes in turn reflect the quality of in-situ understanding achieved. The interaction of these various aspects of the activity is "homeostatic" or compensatory; when the contribution of one subsystem either input, processing or product is low, the other will become high to maintain a kind of notetaking equilibrium.

Let it be stated that the present concern with cognitive modelling is not to be taken as implying that notetaking is an exclusively cognitive activity. The studies reported here have not investigated the affective factors which accompany notetaking and consequently the model to be proposed does not include such information. While it is our considered opinion that attention to affective

and/or motivational factors is necessary to build a model that comprehensively represents and contextualizes notetaking activity, it is equally our belief that this fact does not invalidate separate investigation of the core processes involved, which are indeed cognitive. If this opinion cannot be upheld, then not just the present studies, but nearly all of previous research becomes invalidated.
The reason for the neglect of non-cognitive aspects of notetaking behaviour may lie in the fact that nearly all the studies encountered in the literature and even the present one have been conducted with student subjects. It could be argued that they represent the natural notetaking population. The problem that arises, though, is one of a possible misrepresentation of the activity if all notetaking is equated with student notetaking . Other groups of individuals, notably academics, do take notes as well, at talks and lectures. The motivational aspects for these note takers are often far removed from any need to impress a teacher or pass examinations. Thus the distinct motivational quality of student notetaking may not be shared by other groups of note takers. To fully understand notetaking activity, it is believed that some investigation of non-student notetaking could be of considerable value.

8.4 CONCLUSIONS & RECOMMENDATIONS

The following global conclusions originate from the findings reported.

1. Student notetaking should be viewed as a system of operations comprising input, processing and product variables which are related to both immediate and substantive comprehension outcomes.

2. Notetaking activity can be described within the framework of a system which is self-equilibrating.

3. Either concise or expansive notes can be useful for different kinds of note takers.

4. Notes produced at lectures can be used for descriptive and diagnostic purposes i.e. to produce descriptions of processes deployed or to identify the occurrence of ineffective learning.

It follows from the above that:

1. Notetaking research should reflect the systemic nature of the activity by clearly delineating which subsystem is in focus.

2. Ready-made prescriptions for optimal notetaking performance are difficult to provide even now, as the results of the present studies suggest that different processing strategies are effective for different types of note takers. But of course to be able to make differential recommendations is a an ultimate goal for continuing research. It is our opinion that research with not only learners but with expert note takers and comprehenders- perhaps academic staff in higher institutions of learning will provide further useful illumination.

3. Training notetaking skills should focus on specific operators identified in Fig. 8.2 where the direct influence can then be monitored in note quality and quantity.

4. Finally, because notetaking is evidently associated with reviewing, notes recorded at lectures, reviewing itself should be examined along the lines proposed in this thesis. This should involve the identification of microprocesses in note-reviewing activity within an information processing framework to provide a picture complementary to that given in the present thesis. Obviously the ultimate goal in notetaking research as stated in Chapter 3 should be to identify useful and effective strategies that

could be taught to note takers. It is believed that this can be achieved when research questions concerning notetaking as well as note reviewing processes and operations are addressed.

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Appendix 5.1

Text of Video Lecture

Hello,

Today I am going to talk about Psychology as a subject the sort of thing you might study at University or even go ahead to do as a career and I wondered best how to go about it and I thought well many people do have a natural idea anyway about what Psychology is and what it does and if I were to ask you for example what do Psychologists do? What is Psychology about? You'd probably answer well its about how people think, why they do things, about intelligence, things like that. Though in fact those are very close to being what Psychology is about. This discipline of Psychology as you find it now if you get on the Psychology degree at university or some college didn't arrive from nowhere. It has a past. It has a history and in fact this sort of question about how people think, what thinking is how people solve problems, why people do things, they do have been asked for many many years. In fact you can go back to the Greeks and perhaps well beyond that. But in this diagram I have got here what I'm going to try and do is to represent for you in a rather simple way where Psychology come from. It didn't just drop out of the sky it came from a kind of history and if we go back, if we make our starting point in the seventeenth century, we find that English Philosophers and one or two of these names you may know, I don't know, people like John Locke, Bishop Berkeley, David Hume. They were asking this very question. What is mind? How is it we are consciously aware of what goes on around us? It is a very obvious thing that we take for granted as ordinary people. But of course philosophers were supposed to ask this sort of question and when they ask the question, what is mind? What is mental life? They said that, well, all it can be really is things coming from the outside making some impression inside our heads. In some sense the outside world writes itself on our selves and this process of writing is indeed the ideas that we say we have in our heads. So all information that we have in our heads comes from the outside and they were called the empiricist philosophers because they believed experience is the key to understanding. What is mind? Mind is made up of the sum of all the ideas tht we have inside our heads.

That influence that somehow one can take mind and break it up into little constituent parts, these parts being the elementary ideas carries right through the 18th and 19th century to, I've marked this here as a sort of a key point in the development or Psychology, a gentleman called Wundt was working in Germany in 1875 and he's important for this reason. He represents a coming together of two influences a coming together of this philosophical influence that says yes we must look at the dimensions of mind, what are the elements of mind, what it breaks up into, analyse mind into its elements.

But the way of doing it was something he picked up from the physiology tradition. The physiologists in the 19th century were very powerful very influential and it was a time of great discovery in physiology as you may know. Things like the nature of nervous function. The idea that nervous transmission was electrical. The idea that different nerves had only one kind of function and out of this tremendously important era in physiology perhaps one name stands out, the German Physiologists Helmholtz. Helmholtz was in fact the teacher of Wundt.

So what you get in this one person here establishing the psychology laboratory, was a fusion a coming together, a convergence, of philosophical questions. What is the nature of mind? How can we split it up into its parts, examine it? Tackled by physiological scientific measures. By which I mean using reaction time, time taken to react to something, the idea of getting at the elements of perception, the elements of vision, and learning, by asking people to gaze more and more deeply into the internal processes that go on behind these functions.

So this tradition here, which then came through into the United States by the beginning of this century is probably the most influential on what we call psychology today. Because it is a fact of life that North American Psychology is the most influential. This concern with breaking down both thinking and behaviour into its elementary parts is very much represented in contemporary North America and to a large extent British Psychology. In addition to that particular line of influence which I've simplified greatly purely for the sake of making a sense of context.

You have other influence as well. I've taken just one of those as a kind of foil a kind of contrast to this influence here and that is the influences of Freud. Who also came on the scene as you can see round about 1900 and his contribution to modern contemporary psychology was very different indeed from this one. Where-as this tradition here is much more concerned with the observable, the analyzable, the idea of splitting up mental life into the elements, dimensions, Freud believed that the more interesting aspects of mental life were not available to that kind of approach. That there were underlying the more obvious parts of what we experience in our daily life. So while this was a psychology about conscious life, if you like, Freud was promoting psychology of unconscious life and the idea that underneath our surface behaviours, underneath our surface thinking, there are motivating things that drive us, causes, reasons, that are not always available to us. We don't often understand why we do certain things. The reasons for these behaviours in the present may be embedded and buried in the past perhaps in our upbringing perhpas in our very early years and so on.

The essential point that Freud was making was that okay if you want to you could be concerned about conscious mental life. But also take into account that a large part of perhaps the larger part of our total mental life also lies outside immediate access and only comes through for example experiences like dreams or comes through when we feel depressed or something. We don't know why yet we feel there is some kind of thing going on. Mood changes, all of these indicators are suggestions that there's something going on below the surface.

Well, that's as I say a very simplified account of the position, we have in contemporary psychology. But what it means is that because of these different influences coming together that if you pick up a basic text book, an introductory text in Psychology you might well be amazed by the variety of things going on. For example, I've got here such a text, introduction to Psychology, nothing special about it, just a fairly typical book and in Chapter One gives examples of the sorts of questions that do get asked in contemporary Psychology, so for example, if you do go to college and you do a degree in Psychology you will find that you come across this sort of question.

For example, the first example they've given, what makes us laugh and why do people have different senses of humour? Interesting question isn't it? There are certain things that we call standard jokes you tell a standard joke and most people laugh at it. That's a simple thing to explain. But also you notice, don't you, that sometimes you are telling a simple story and some people laugh and some don't and you wonder why it is that some people laugh and some dont. Are there individual differences in sense of humour and if there are where do they come from? Is it part of our personality? Is that in turn a part of our particular upbringing? Why do some people laugh when the story has someone falling down and hurting themselves and why do other people react quite differently?

Second example is, how can we improve our everyday memories? So memory is a part of Psychology? Yes. How we store things. How we remember them. How we can retrieve things from our memory. This question how can we improve our everyday memories, yes, a good question to ask and you may indeed see from time to time in some newspapers, advertisements claiming that, if you take my course, you follow my course, I will improve your memory in forty days or something and typically those sorts of schemes do have devices for improving memory. Such as yu remember a little picture with the item you do want to remember for example if you want to remember the number one, you've got to remember that one is a bun, two is a shoe, three is a tree, and by assembling a bizarre complex of pictures it seems easier to remember abstract information like numbers. So the idea is essentially to pictorialize. That is one particular process of improving memory to sort of support it with pictures. But the more general question of improving everyday memory is subject to a lot of research and it is not just about that particular sort of approach.

Another question they've got down in this book here is, why do we sometimes see and hear things that are not there? Ah yes, for example, illusions or hallucinations. You may know from experience, again, that if you are very tired, things seem to move that don't really move. That if you're upset or very upset, under stress, sometimes you can get the impression that things happen that don't really happen. If you've been very drunk, and there are different sorts of states where people do report hallucinatory things going on. So that it seems possible that part of our mental life isn't indeed due to things out there but to things which originate inside out heads.

What makes people some people leaders and others followers? A different sort of question. Again we are now talking about particular aspects of what we call personality that makes people able to direct and manage others whereas other people are more content to follow to say yes I'll do this and to be constructive in a different sort of way. There's a kind of type, if you like, or person who makes a leader and perhaps a type of person who makes a follower and to investigate the nature of these different types is again a legitimate part of Psychology.

Why do we often loose track of conversation at parties? Can intelligence be increased if children are brought up in particular ways? That's perhaps an interesting one to stop with. Em, the idea that you might be able to improve or at least influence people's intelligence, children's intelligence by the way you bring them up either by dictory

means or particular kinds of experience. For example, if you put young child in an environment where there's lots of books to read, lots of things going on, lots of stimulation. Is it the case, that they become somehow more intelligent because of this relative to the child who has a much more bland or deprived experience? That sort of question and so on.

So I've now given all of those examples here. Those are to catch the flavour but what I've done on this next diagram is to systematically represent the different areas of Psychology. I don't want to get you too confused by reading all these at once so I'll take you through each one a step at a time.

Now the first one, there's no particular importance of the order here. But cognitive psychology is that area of psychology concerned with the nature of thinking. The nature of memory. How people form new ideas. How it is that we do remember things. Is there a long term deep memory? Is there a short term memory? What is the importance of attention? Does it matter whether we pay attention to something when we try to pick things up? The whole nature of how we solve problems. How we learn. The nature of language. All those fall under the heading of cognitive psychology. Now it's quite a big area.

In a sense developmental takes many of those points and says, well, look, given that we can ask the question, what's the nature of thinking? What's the nature of memory and so on. How does it change between the new born and the adult and developmental psychology as you might expect tracks traces of the changes in for example, language. The child's first babbling sounds. How they move into language proper. In the case of the adult how early expression of emotion or experience of emotion becomes more mature as a child gets older. How indeed the child moves from simply lying on the floor waving its arms and legs about to becoming a fully ambulent adult. How in other words voluntary behaviours take over from purely reflex behaviours mostly the development. Anything concerning the movement from the new born infant right through to the adult is material for the developemntal psychologist.

Now the next heading I've got down there is social psychology. And as you might expect from the name, is concerned with how people form impressions of other people. For example what factors influence the impression you form of someone? Are first impressions very important or can they be overruled by later experience? The nature of relationships between two people. When a relationship starts. What are the important factors in an early relationship as opposed to a later one? I put down here attitudes. These are rather important too. What determines the attitudes we have towards something of importance like political attitudes, racial attitudes, attitudes towards anything you like, attitudes towards television, attitudes towards psychology lectures indeed. So again first to give you the flavour social psychologists are concerned with the area of relationships between one person and another anything about how one person relates to another or to a small group of people is the domain of social psychology. So we've said so far, that cognitive psychology is about essentially what goes on inside your head, thinking, memory, problem solving, forming ideas. Developmental, is about how the whole array of psychological processes develops from the infant to the adult. Social is about what goes on between people.

Then we come unto clinical this concerns when people in some form of distress, some form of upset, for example, if a person comes along to the clinic suffering from anxiety or depression then the clinical Psychologist may for example give some tests to establish what particular problem it is. May then do some counselling. May do some psychotherapy to help the person understand the background reasons for the anxiety or depression or the moodiness, call it what you like, giving rise to discomfort and by structuring, by giving a picture, by allowing the person access to reasons why the behaviour is operating, thereby to release the person from the problem to some extent.

Physiological, is much closer to, as you can imagine from the name, Physiology or Biology or anatomy. It's about the structural, about the substrate, of the behaviour. How our outward behaviour, or vision, our learning, what we are consciously aware of, is supported by the brain and the nervous system. For example, how brain centres control appetites, sexual behaviour, vision. How the whole array of our sensory functions and motives and needs are controlled by different centres in the brain. A very large area physiological psychology. Another example is the way in which hormones such as the sex hormones or adrenalin and the whole range of hormones influence behaviour. Much of this is done with animals but much also with patients in a hospital setting. So people who are concerned with the substrate, the basis of behaviour, what gives rise to behaviour, are physiological psychologists.

There is also psychology concerned with what is called psychometrics. Measuring things, metrics, measuring, yes. Given that we have a concept like intelligence or IQ is perhaps a more familiar team, how de we measure it? What are the tests available? Some of them paper and pencil tests, some are a bit more elaborate. But the idea of psychometrics is that we can measure the qualities of a person. Intelligence is the most obvious example but I put also down here personality because there is the idea that we can divide up personality into different sorts of dimensions. How warm a person is, how friendly, how out-going, extroverted, how reliable, and so on. One could, as it were, go through the dictionary and pull out a whole number of adjectives that refer to peoples dispositions or personalities indeed and we can measure them on those different dimensions.

The last one I put down here, is comparative psychology, where we do look at animal behaviour as a means of either, well, for two reasons. First of all animal behaviour is interesting itself. Many psychologists study animal behaviour like hunger patterns and so on for its own sake. But also as a kind of model of human behaviour. You can do things with animals which you can't so readily do with humans for ethical reasons and so on. For example if you want to know the effect of hunger on some behaviour, it is quite difficult, for ethical reasons, to keep a person off food for a day but you can more easily if the justification is there, keep an animal off food for a day.

Appendix 5.2a

FEDERAL COLLEGE OF EDUCATION (TECHNICAL) LAGOS
NIGERIAN CERTIFICATE OF EDUCATION

EDUCATIONAL PSYCHOLOGY EDU.202

TERM 1 COURSE OUTLINE: 1988/89 Session

UNIT 1

1.1 Basic Understanding of Psychology

1.2 The various branches of Psychology

1.3 Methods in Psychological Investigation

1.4 The place and scope of Educational Psychology

1.5 Relevance of Educational Psychology

UNIT 2 Growth and Development

2.1 Distinguishing between growth and development

2.2 General principles of growth and development

2.3 Stages of human development

2.4 Influence of heredity and environment

Appendix 5.2b

FEDERAL COLLEGE OF EDUCATION (TECHNICAL) LAGOS

NIGERIAN CERTIFICATE OF EDUCATION

EDUCATIONAL PSYCHOLOGY EDU 202

COURSE OUTLINE: 1988/89 Session

UNIT 1

1.1 Basic understanding of Psychology

1.2 The various branches of Psychology

1.3 Methods in Psychological Investigation

1.4 The place and scope of Educational Psychology

1.5 Relevance of Educational Psychology

UNIT 2 Growth and Development

2.1 Distinguishing between growth and development

2.2 General principles of growth and development

2.3 Stages of human development (physical)

2.4 Influence of heredity and environment

UNIT 3 Adolescence

3.1 Identify and explain the problems associated with the period

3.2 Adolescent culture (Nigerian)

UNIT 4 Individual Differences

4.1 Manifestations of individual differences and how they affect learning

4.2 How to cater for individual differences in classroom teaching and learning

UNIT 5 Personality

5.1 Personality theories

5.2 Influence of personality (Teacher/Learner) on classroom teaching

UNIT 6 Learning

6.1 Theories of Learning

6.2 Types of Learning e.g. Skill, Concept, etc

6.3 Factors that affect Learning

6.4 Transfer of Learning

6.5 Memory (Remembering and Forgetting)

UNIT 7 Motivation

7.1 Theories of motivation

7.2 Motivation in the Classroom

Appendix 5.3

TRAINING EVALUATION QUESTIONNAIRE

As a teacher and one of Educational Psychology, I attempt to practice what I teach. I am interested in how and how well students learn in classrooms. It is for the purpose that I require your honest answers to this questionnaire. Your responses will be treated with the greatest confidence.

Thank you.

Introductions

Complete the questionnaire as required by:-

(i) filling in

(ii) putting a tick in the box that best describes your experience

(iii) writing your remarks

Thank you very much.

Florence E Akin-Aina (Mrs)

TRAINING EVALUATION QUESTIONNAIRE

1. Name: ..... Class: .....

2. Sex Male

Female

3. Age

4. How familiar are you with what Psychology is about?

Very familiar

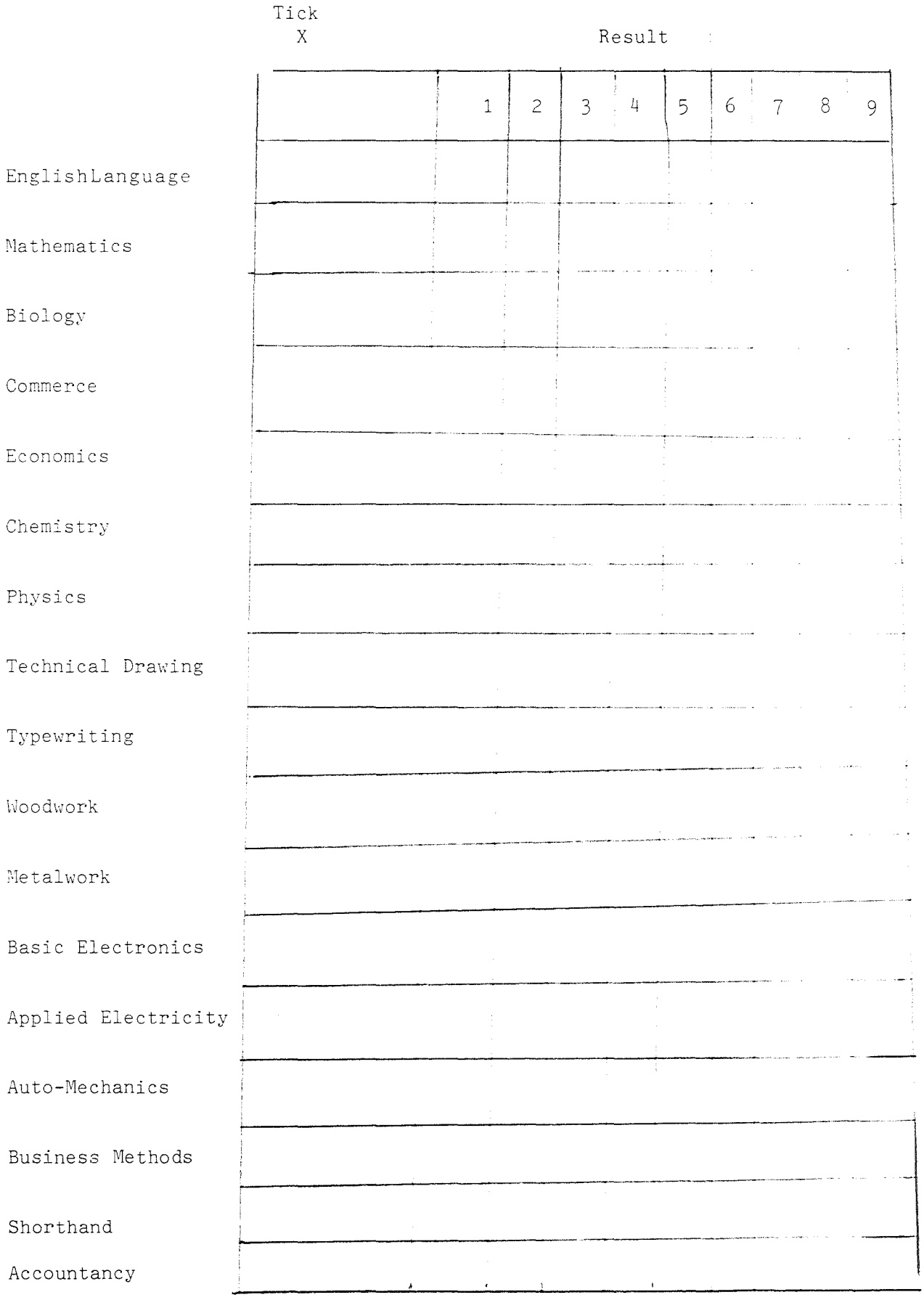
Familiar

Don't Know

Unfamiliar

Very Unfamiliar

5. Which of these subjects do you have at W A S C



6. Do you think any of these subjects has helped you to understand Education Psychology lectures?

Yes ☐

No ☐

7. If your answer to No.7 is yes: which subject/s .....

8. How would you describe your understanding of Educational Psychology lectures this term?

very well ☐

Understood ☐

Not understood ☐

Confused ☐

9. How would you describe your note taking at Educational Psychology lectures this term?

I take notes as I have always done ☐

I take better notes than before ☐

I take worse notes than before ☐

10. My note taking has changed

Yes ☐

No ☐

11. If your answer to No.11 is Yes: Why or how? .....

.....

.....

.....

12. Any remarks you want to make about the teaching of Education Psychology this term?

.....

.....

.....

.....

Appendix 5.4

FEDERAL COLLEGE OF EDUCATION (TECHNICAL) LAGOS

EDUCATIONAL PSYCHOLOGY EDU 202

N C E II Electricity/Electronics (A & B)

Mechanical (A & B)

First Term Test Time: 1 hour only

Instructions: Answer Any TWO Questions only

1. Using a network structure show and describe briefly how the various topic areas in Educational Psychology are related to the parent disciplines of Philosophy and Psychology.

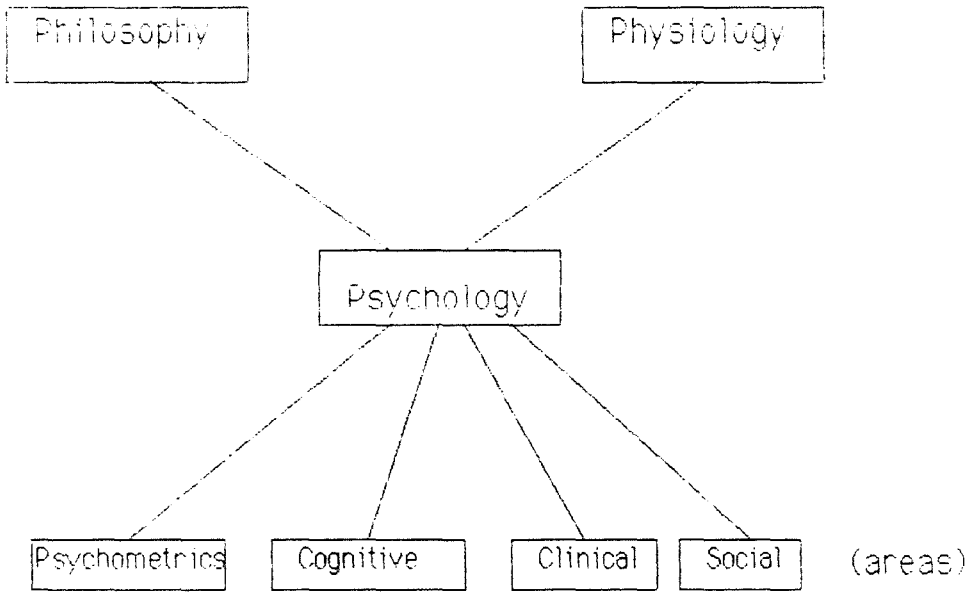
2. Enumerate the utility of the study of the subject Educational Psychology to the classroom teacher.

3. Describe the physical changes that take place at any TWO of the following stages of human development; neonatal period, childhood, adolescence. Using real examples describe TWO of the needs of ONE of the above stages.

4. Neither heredity nor environment ALONE can account for a pupil's classwork. Discuss this statement using examples.

Appendix 5.5

Network diagram from first training session



Appendix 6.1

INSTRUCTIONS

1. Complete the questionnaire as required by:

   i) filling in

   ii) putting a tick X in the box that best describes your experience

   iii) writing a summary

2. Watch and listen to the video taped lecture on introductory Psychology attentively.

3. Take or write notes as normally as you would in any of your lectures in your notebooks (I will collect them at the end of this lecture).

QUESTIONNAIRE

5. Name:

6. Sex Male ☐

   Female ☐

7. Age:

8. How familiar are you with what Psychology is about?

   Very familiar ☐

   familiar ☐

   unfamiliar ☐

   very unfamiliar ☐

Appendix 6.2

NOTE TAKING PROCESSES INVENTORY

INSTRUCTIONS

Place a tick X alongside the behaviour that best describes your reaction while you were listening to the video lecture and taking notes.

		Scoring
1.	While I was listening to the lecture I took notes:-	
	1. All through the lecture	5
	2. Most of the lecture (75%).....	4
	3. About half of the lecture.....	3
	4. About 25% of the lecture.....	2
	5. Not at all.....	1
2.	I did not write any notes when:	
	1. I missed a point.....	1
	2. I was tired.....	2
	3. I was distracted.....	3
	4. The point was a joke.....	4
	5. The point was not important.....	5
3.	I attempted to understand the meaning of what the lecture was saying.	
	1. Strongly agree.....	5
	2. Agree.....	4
	3. Not sure.....	3
	4. Disagree.....	2
	5. Strongly disagree.....	1
4.	I was judging the importance of the points in the lecture.	
	1. Strongly agree.....	5
	2. Agree.....	4
	3. Not sure.....	3
	4. Disagree.....	2

		Scoring
5.	Strongly disagree.....	1

5. How I judged the importance of points in the lecture.

1.	I could not tell which point was more or less important.....	1
2.	When others wrote it down.....	2
3.	When it seems familiar.....	3
4.	The lecture said so.....	4
5.	When the point was repeated.....	5

6. I judged the importance of the points and wrote all of them down.

1.	Strongly agree.....	1
2.	Agree.....	2
3.	Not sure.....	3
4.	Disagree.....	4
5.	Strongly disagree.....	5

7. I judged the importance of the points and wrote notes selectively that is only the points I considered important were in my notes.

1.	Strongly agree.....	5
2.	Agree.....	4
3.	Not sure.....	3
4.	Disagree.....	2
5.	Strongly disagree.....	1

8. In trying to understand the points in the lecture, I tried to relate them to real life situations and experiences to which I thought they apply.

1.	Strongly agree.....	5
2.	Agree.....	4
3.	Not sure.....	3
4.	Disagree.....	2

Scoring

5. Strongly disagree..... 1

9. I tried to change the ideas in the lecture into my own words.

1. Strongly agree..... 5
2. Agree..... 4
3. Not sure..... 3
4. Disagree..... 2
5. Strongly disagree..... 1

10. I wrote the points down as the lecturer said them that is, using the same words.

1. All through the lecture..... 1
2. Only important points..... 2
3. When I could not understand the point..... 3
4. When I understood a point..... 4
5. Never..... 5

11. I judged the importance of the ideas before changing them into my own words.

1. Strongly agree..... 5
2. Agree..... 4
3. Not sure..... 3
4. Disagree..... 2
5. Strongly Disagree..... 1

12. How well do you think you understood the lecture?

1. Very well..... 5
2. Well..... 4
3. Not sure..... 3
4. Not very well..... 2
5. Not understood/confused..... 1

Appendix 7.1

Text of Video Lecture

Hello

I have been asked to talk about Psychology as a subject the sort of thing you might study at college or even go ahead to do as a career and I wondered best how to go about it and I thought well many people do have a natural idea anyway about what Psychology is and what it does and if I were to ask you for example what do Psychologists do what is Psychology about you'd probably answer well its about how people think why they do things about intelligence things like that though in fact those are very close to being what Psychology is about/ this discipline of Psychology as you find it now if you get on the Psychology degree at university or some college didn't arrive from nowhere it has a past it has a history and in fact this sort of question about how people think what thinking is how people solve problems why people do things they do have been asked for many many years in fact you can go back to the Greeks and perhaps well beyond that but in these diagrams I have got here what I'm going to try and do in this first diagram at least is to try to represent for you in a rather simple way where Psychology come from. It didn't just drop out of the sky it came from a kind of history/ and if we go back if we make our starting point in the seventeenth century we find that English Philosophers and one or two of these names you may know I don't know people like John Locke Bishop Berkeley David Hume they were asking this very question what is mind how is it we are consciously aware of what goes on around us it is a very obvious thing that we take for granted as ordinary people but of course philosophers were supposed to ask this sort of question and when they ask the question what is mind what is mental life they said that well all it can be really is things coming from the outside making some impression on our brains on our never mind brains inside our heads in some sense the outside world writes itself on our selves and this process of writing is indeed the ideas that we say we have in our heads. So all information that we have in our heads comes from the outside and they were called the empiricist philosophers because they believed experience is the key to understanding what is mind mind is made up of the sum of all the ideas that we have inside our heads a very simple a very obvious position to take/ and infact that influence that somehow one can take mind and break it up into little constituent parts these parts being the elementary ideas carries right through the 18th and 19th century to I've marked this here as a sort of a key point in the development or Psychology a gentleman called Wundt was working in Germany in 1875 and he's important for this reason he represents a coming together of two influences a coming together of this philosophical influence that says yes we must look at the dimensions of mind what are the elements of mind what it breaks up into analyse mind into its elements/ but the way of doing it was something he picked up from the physiology tradition the physiologists in the 19th century were very powerful very influential and it was a time of great discovery in physiology as you may know things like the nature of nervous function the idea that nervous transmission was electrical the idea that different nerves had only one kind of function and out of this

tremendously important era in physiology perhaps one name stands out the German Physiologists Helmholtz. Helmholtz was in fact the teacher of Wundt/ so what you get in this one person here establishing the psychology laboratory was a fusion a coming together a convergence of philosophical questions what is the nature of mind how can we split it up into its parts examine it tackled by physiological scientific measures by which I mean using reaction time time taken to react to something the idea of getting at the elements of perception the elements of vision and learning by asking people to gaze more and more deeply into the internal processes that go on behind these functions/ so this tradition here which then came through into the United States by the beginning of the century is probably the most influential on what we call psychology today because it is a fact of life that North American Psychology is the most influential this concern with breaking down both thinking and behaviour into its elementary parts is very much represented in contemporary North America and to a large extent British Psychology in addition to that particular line of influence which I've simplified greatly purely for the sake of making a sense of context/ you have other influence as well. I've taken just one of those as a kind of foil a kind of contrast to this influence here and that is the influences of Freud who also came on the scene as you can see round about 1900 and his contribution to modern contemporary psychology was very different indeed from this one where as this tradition here is much more concerned with the observable the analyzable the idea of splitting up mental life into the elements dimensions Freud believed that the more interesting aspects of mental life were not available to that kind of approach that there were underlying the more obvious parts of what we experience in our daily life so while this was a psychology about conscious life if you like Freud was promoting psychology of unconscious life and the idea that underneath our surface behaviours underneath our surface thinking there are motivating things that drive us causes reasons that are not always available to us we don't often understand why we do certain things the reasons for these behaviours in the present may be embedded and buried in the past perhaps in our upbringing perhaps in our very early years and so on/ the essential point that Freud was making was that okay if you want to you could be concerned about conscious mental life but also take into account that a large part of perhaps the larger part of our total mental life also lies outside immediate access and only comes through for example experiences like dreams or comes through when we feel depressed or something we don't know why yet we feel there is some kind of thing going on mood changes all of these indicators are suggestions that there's something going on below the surface/ well that's as I say a very simplified account of the position we have in contemporary psychology but what it means is that because of these different influences coming together that if you pick up a basic text book an introductory text in Psychology you might well be amazed by the variety of things going on for example I've got here such a text, introduction to Psychology nothing special about it just a fairly typical book and in Chapter One gives examples of the sorts of questions that do get asked in contemporary Psychology so for example if you do go to college and you do a degree in Psychology you will find that you come across this sort of question/ for example the first example they've given what makes us laugh and why do people have different senses of humour interesting question isn't it there are certain things that we call standard jokes you tell a standard joke and

most people laugh at it that's a simple thing to explain but also you notice don't you that sometimes you are telling a simple story and some people laugh and some don't and you wonder why it is that some people laugh and some dont are there individual differences in sense of humour and if there are where do they come from is it part of our personality is that in turn a part of our particular upbringing why do some people laugh when the story has someone falling down and hurting themselves and why do other people react quite differently/ second example is how can we improve our everyday memories So memory is a part of Psychology yes how we store things how we remember them how we can retrieve things from our memory this question how can we improve our everyday memories yes a good question to ask and you may indeed see from time to time in some newspapers advertisements claiming that if you take my course you follow my course I will improve your memory in forty days or something and typically those sorts of schemes do have devices for improving memory such as you remember a little picture with the item you do want to remember for example if you want to remember the number one you've got to remember that one is a bun two is a shoe three is a tree and by assembling a bizarre complex of pictures it seems easier to remember abstract information like numbers so the idea is essentially to pictorialize that is one particular process of improving memory to sort of support it with pictures but the more general question of improving everyday memory is subject to a lot of research and it is not just about that particular sort of approach/ another question they've got down in this book here is, why do we sometimes see and hear things that are not there ah yes for example illusions or hallucinations you may know from experience again that if you are very tired things seem to move that don't really move that if you're upset or very upset under stress sometimes you can get the impression that things happen that don't really happen ff you've been very drunk and there are different sorts of states where people do report hallucinatory things going on so that it seems possible that part of our mental life isn't indeed due to things out there but to things which originate inside out heads/what makes people some people leaders and others followers a different sort of question again we are now talking about particular aspects of what we call personality that makes people able to direct and manage others whereas other people are more content to follow to say yes I'll do this and to be constructive in a different sort of way there's a kind of type if you like or person who makes a leader and perhaps a type of person who makes a follower and to investigate the nature of these different types is again a legitimate part of Psychology/ why do we often loose track of conversation at parties can intelligence be increased if children are brought up in particular ways that's perhaps an interesting one to stop with em the idea that you might be able to improve or at least influence people's intelligence children's intelligence by the way you bring them up either by dictory means or particular kinds of experience for example if you put young child in an environment where there's lots of books to read lots of things going on lots of stimulation is it the case that they become somehow more intelligent because of this relative to the child who has a much more bland or deprived experience that sort of question and so on/ so I've now given all of those examples here those are to catch the flavour but what I've done on this next diagram is to systematically represent the different areas of Psychology I don't want to get you too confused by reading all these at once so I'll take you through each one a step at a time/ now

the first one there's no particular importance of the order here. But cognitive psychology is that area of psychology concerned about the nature of thinking the nature of memory how people form new ideas how it is that we do remember things is there a long term deep memory is there a short term memory what is the importance of attention does it matter whether we pay attention to something when we try to pick things up the whole nature of how we solve problems how we learn the nature of language all those fall under the heading of cognitive psychology now it's quite a big area/ in a sense developmental takes many of those points and says well look given that we can ask the question what's the nature of thinking what's the nature of memory and so on how does it change between the new born and the adult and developmental psychology as you might expect tracks traces of the changes in for example language the child's first babbling sounds how they move into language proper in the case of the adult how early expression of emotion or experience of emotion becomes more mature as a child gets older how indeed the child moves from simply lying on the floor waving its arms and legs about to becoming a fully ambulent adult how in other words voluntary behaviours take over from purely reflex behaviours mostly the development anything concerning the movement from the new born infant right through to the adult is material for the developemntal psychologist/ now the next heading I've got down there is social psychology and as you might expect from the name is concerned with how people form impressions of other people for example what factors influence the impression you form of someone are first impressions very important or can they be overruled by later experience the nature of relationships between two people when a relationship starts what are the important factors in an early relationship as opposed to a later one I put down here attitudes these are rather important too what determines the attitudes we have towards something of importance like political attitudes racial attitudes attitudes towards anything you like attitudes towards television attitudes towards psychology lectures indeed so again first to give you the flavour social psychologists are concerned with the area of relationships between one person and another anything about how one person relates to another or to a small group of people is the domain of social psychology/ so we've said so far that cognitive psychology is about essentially what goes on inside your head thinking memory problem solving forming ideas developmental is about how the whole array of psychological processes develops from the infant to the adult social is about what goes on between people/ then we come unto clinical this concerns when people in some form of distress some form of upset for example if a person comes along to the clinic suffering from anxiety or depression then the clinical Psychologist may for example give some tests to establish what particular problem it is may then do some counselling may do some psychotherapy to help the person understand the background reasons for the anxiety or depression or the moodiness call it what you like giving rise to discomfort and by structuring by giving a picture by allowing the person access to reasons why the behaviour is operating thereby to release the person from the problem to some extent/ physiological is much closer to as you can imagine from the name Biology or anatomy it's about the structural about the substrate of the behaviour how our outward behaviour or vision our learning what we are consciously aware of is supported by the brain and the nervous system for example how brain centres control appetites sexual behaviour vision how the whole array of our sensory functions and motives and needs are

controlled by different centres in the brain a very large area of physiological psychology another example is the way in which hormones such as the sex hormones or adrenalin and the whole range of hormones influence behaviour much of this is done with animals but much also with patients in a hospital setting so people who are concerned with the substrate the basis of behaviour what gives rise to behaviour are physiological psychologists/ there is also psychology concerned with what is called psychometrics measuring things metrics measuring yes Given that we have a concept like intelligence or IQ is perhaps a more familiar team how de we measure it what are the tests available Some of them paper and pencil tests some are a bit more elaborate but the idea of psychometrics is that we can measure the qualities of a person intelligence is the most obvious example but I put also down here personality because there is the idea that we can divide up personality into different sorts of dimensions how warm a person is how friendly how out-going extroverted how reliable and so on one could as it were go through the dictionary and pull out a whole number of adjectives that refer to peoples dispositions or personalities indeed and we can measure them on those different dimensions/ the last one I put down here is comparative psychology where we do look at animal behaviour as a means of either well for two reasons first of all animal behaviour is interesting itself many psychologists study animal behaviour like hunger patterns and so on for its own sake but also as a kind of model of human behaviour you can do things with animals which you can't so readily do with humans for ethical reasons and so on For example if you want to know the effect of humger on some behaviour it is quite difficult for ethical reasons to keep a person off food for a day but you can more easily if the justification is there keep an animal off food for a day/

Appendix 7.2.

INFORMATION SHEET

Hello,

I am a teacher interested in how students learn in classrooms. It is for this reason that I am here today. I hope that you will give me your full co-operation in following the instructions carefully. Your responses will be treated with the greatest confidence.

Instructions

1. Complete the questionnaire as required by:

   i) filling in

   ii) putting a tick in the box that best describes your experience

   iii) writing a summary

2. Watch and listen to the video taped lecture on introductory Psychology attentively.

3. Take/write notes as normally as you would in any of your lessons on the sheets of paper provided. (I would like to collect your notes at the end).

4. In the left margins of your notes score the lecture for comprehension when the tape pauses using this key:-

   (a) definitely understood

   (b) probably understood

   (c) don't know/unsure

   (d) probably not understood

   (e) definitely not understood

5. At the end of video lecture, write down what you have learned from the lecture you have just seen on tape. Imagine a younger friend of yours asked you to tell him/her all you know about Psychology - write down what you will say to him/her.

Thank you very much

FLORENCE E AKIN-AINA

QUESTIONNAIRE

1. Name .....

2. Sex Male ☐

Female ☐

3. Age

4. How familiar are you with what Psychology is about?

Very familiar ☐

Familiar ☐

Don't Know ☐

Unfamiliar ☐

Very Unfamiliar ☐

5. Write a short summary of what you think Psychology is and what it is about.